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PHYSICS ABSTRACTS

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SECTION A OF SCIENCE ABSTRACTS

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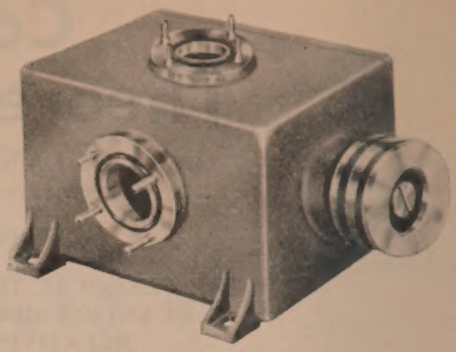

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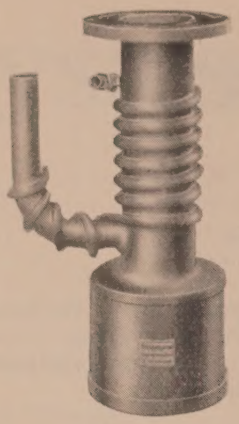

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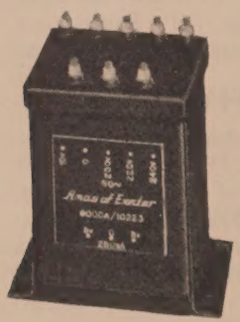

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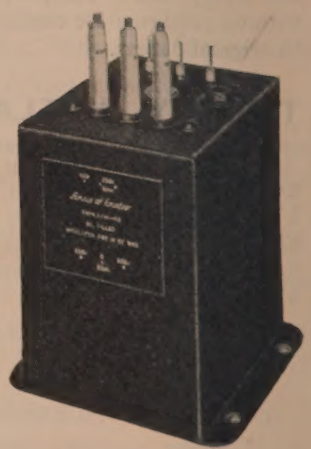

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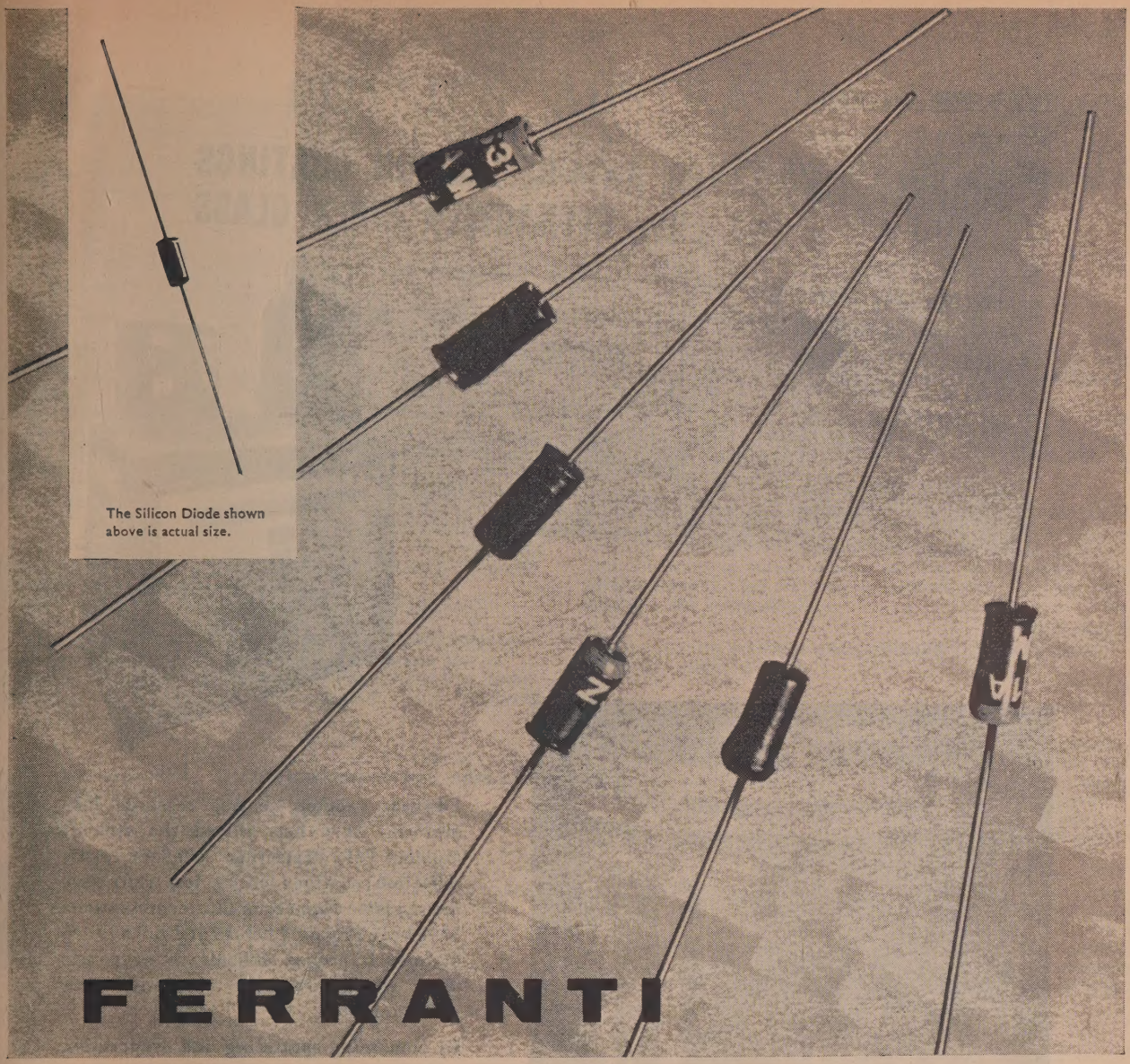

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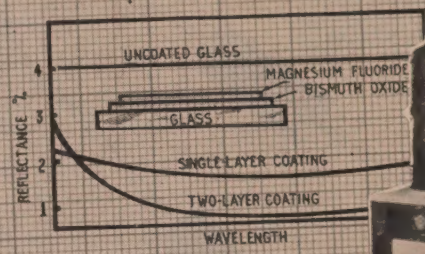

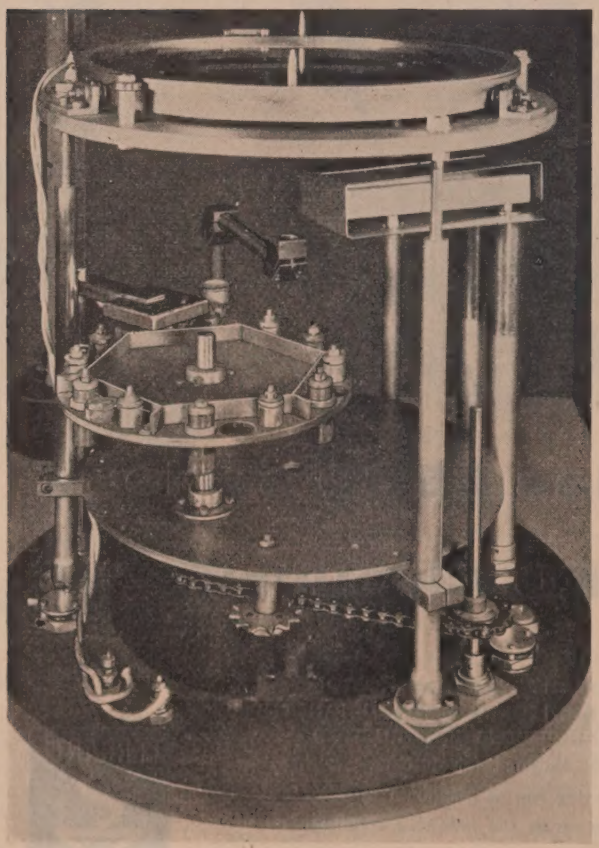

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PHYSICS ABSTRACTS

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MATHEMATICS

517.5

10492. ASYMPTOTIC EXPANSIONS OF WEBER FUNCTIONS. R.Yamada.
J. Phys. Soc. Japan, Vol. 13, No. 4, 428-9 (April, 1958).

Asymptotic expansions are obtained of the solutions of modified Weber's equation $y'' + (\alpha - x^2/4)y = 0$, valid for $\pi/4 > \arg x > -\pi/4$. This paper completes previous work by the author (Abstr. 2906 of 1955). J.K.Skwirzynski

517.544 : 518.5

10493. EXPERIMENTAL SOLUTION OF DIRICHLET'S PROBLEM FOR THE HALF-SPACE $Z > 0$. D.Zidarov.
C.R. Acad. Bulg. Sci., Vol. 11, No. 3, 181-4 (May-June, 1958).
In French.

The experimental solution of the problem was established by using an electromagnetic model. The unknown function (and its derivatives) are determined by measuring the potential (and its derivatives) of the modelling electromagnetic field. P.Roman

517.544 : 518.5

10494. EXPERIMENTAL SOLUTION OF NEUMANN'S PROBLEM FOR THE HALF-SPACE $Z > 0$. D.Zidarov.
C.R.Acad. Bulg. Sci., Vol. 11, No. 4, 267-70 (July-Aug., 1958).
In French.

The vertical gradient (in the z-direction) of a harmonic function $U(x,y,z)$, in the plane $z = o$, defines a unique electromagnetic field, whose potential function φ is proportional to U_z in the half-space $z > 0$. Hence, U can be found as an integral of φ over the half-space. The value of such integral can be verified experimentally by means of a special "integrating frame" (illustrated) placed in the field φ. The voltage induced in this frame is proportional to U. J.K.Skwirzynski

517.9 : 534.26

INVERSION FORMULA FOR THE SOMMERFELD INTEGRAL. See Abstr. 9339

518.5 : 591.51

10495. INITIATION OF PATTERN RECOGNITION AND TRIAL-AND-ERROR LEARNING IN A CONDITIONAL PROBABILITY COMPUTER. A.M.Uttley.
Rev. mod. Phys., Vol. 31, No. 2, 546-8 (April, 1959).

A description of an electronic machine which, when connected with appropriate input and output devices, can "recognize" patterns and can "learn" by trial and error. It is suggested that the engineer may help to bridge the gap between structure and behaviour in biological systems and that the study of machines such as the one described is a step in this direction. J.Iball

518.5 : 535.317

ANALOGUE FOURIER TRANSFORMER FOR APODIZATION STUDIES. See Abstr. 9375

519.4

10496. APPLICATIONS OF FINITE GROUPS. J.S.Lomont.
New York: London: Academic Press (1959), xi + 346 pp.

This book consists of a concise exposition of the mathematical background to the applications of group theory in physics and chemistry, with a great many detailed examinations of particular applications. The mathematical exposition assumes prior familiarity with the elements of matrix theory and of general group theory, and is concentrated mainly on representation theory. The discussion of applications assumes a knowledge of quantum mechanics: the applications are mainly drawn from the theories of atomic, molecular and crystal structure, with some discussions of topics from nuclear theory and quantum field theory. There are several hundred references and many tabulations of representations, etc., needed in the applications. The book should be most useful to anyone embarking on the application of group theory to problems in mathematical physics, chemistry or crystallography. J.Hawgood

ASTROPHYSICS

521.2

10497. A NOTE ON THE SOLUTION OF KEPLER'S EQUATION. M.K.Ventsel'.
Astron. Zh., Vol. 35, No. 4, 672-3 (1958). In Russian. English translation in : Soviet Astron—AJ (New York), Vol. 2, No. 4, 625-7 (July-Aug., 1958).

A method is given for the solution of Kepler's equation which is convenient for calculations with an arithmometer or a calculating machine.

522.6

10498. THE TOWER TELESCOPE OF GÖTTINGEN OBSERVATORY. II. INSTRUMENTAL ADJUNCTS AND IMPROVEMENTS. P. ten Bruggencate and H.H.Voight.
Nachr. Akad. Wiss. Gottingen, math.-phys. Kl. 11a, 1958, No. 8, 189-211. In German.

A detailed description (with illustrations) of the ancillary equipment of the tower telescope described in Pt. I (Abstr. 4857 of 1952). These include spectrographic apparatus with plane, and concave gratings; prism monochromator for the observation of high-order spectra free of interfering lines; narrow-band interference filters for solar work on the Hα region; standardizing spectrograph incorporating a krypton lamp; and a direct-recording photoelectric spectrophotometer. D.R.Barber

522.612

10499. THE USE OF MULTI-STAGE ELECTRON-OPTICAL LIGHT AMPLIFIERS IN ASTROPHYSICS.
M.M.Butslov, E.K.Zavoiskii, A.A.Kalinyak, V.B.Nikonov, V.V.Prokof'eva and G.E.Smolkin.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 5, 815-18 (1958). In Russian.

The photography of weak astronomical images is discussed, and the desirability of developing light amplifiers, in order to overcome the limitation imposed by modern powerful telescopes for certain classes of problem, is noted. The use of a particular multi-stage light-amplifier is especially considered and its gain is estimated to be in the order of 1000, after the decrease in resolution (compared with that for direct photography) has been taken into account; the light amplifier can resolve 10-20 lines/mm. Photographs of several objects are shown, using the intensifier in conjunction with a 50 cm Maksutov meniscus telescope, and the results obtained are in agreement with those expected. Here, the inherent noise of the amplifier is at least two orders less than that due to night-sky illumination, and an exposure of 1 minute is used to photograph a 16th magnitude star. V.V.Zakharov

522.615

10500. REDUCTION OF PHOTOELECTRIC OBSERVATIONS BY AN ELECTRONIC COMPUTER. H.C.Arp.
Astrophys. J., Vol. 129, No. 2, 507-12 (March, 1959).

A programme for the automatic reduction of deflections obtained from a photoelectric photometer is described. The computation is started with a set of mean extinction coefficients, and colours and magnitudes of all stars are computed on the system of the standard stars present. A second approximation to the extinction is then computed from all the standard stars present, and all magnitudes and colours are then recomputed with this new value of extinction. The programme permits a schedule of observations which increases efficiency at the telescope, and the electronic computer enables easier tabular handling of data, higher accuracy, and a data-processing which is about ten times faster than that previously obtainable with small calculators.

523.161

10501. INTERPLANETARY DUST DISTRIBUTION. D.B.Beard.
Astrophys. J., Vol. 129, No. 2, 496-506 (March, 1959).

A detailed calculation of the dust-scattered light at very small elongations from the sun (2-10 solar radii) reveals (1) that the dust is distributed as $r^{-\nu}$, where r is the distance from the sun and ν is some number possibly less than, but most probably equal to, 1.5; (2) that the minimum radius of the dust particles is a few microns; (3) that the particle concentration depends on the particle radius, a, as a^{-p}, where p is a number possibly equal to, but most probably greater than, 2.5; (4) that the scattered light should depend linearly on the square root of the wavelength of the light; (5) that the concentration of dust at the earth's orbit is, to a good approximation, 10^{-14}-10^{-15} particle/cm^3; but (6) that, because of the earth's gravitational field, the concentration at the earth's surface may be increased to as much as 10^{-10}-10^{-11} particle/cm^3. A less precise calculation of the zodiacal light observed at large elongations from the sun (greater than 30°) favours the upper limit to ν for the radial distribution of the coronal calculation and confirms the absolute value of the concentration inferred from the solar corona if the dust albedo is assumed to be approximately 0.1.

523.161

10502. BEHAVIOUR OF IONIZED INTERSTELLAR HYDROGEN IN THE GALAXY. G.Courtès.
C.R. Acad. Sci. (Paris), Vol. 248, No. 21, 2953-5 (May 25, 1959). In French.

It is suggested that the interferential study of H II regions would make possible the determination of the distance of interstellar clouds, and hence the position of the exciting stars in the spiral arms.
R.A.Newing

523.162

10503. THE POSSIBILITY OF ABSORPTION OF SOLAR L_α-RADIATION BY THE INTERPLANETARY MEDIUM. G.M.Nikol'skii.
Astron. Zh., Vol. 35, No. 4, 657-8 (1958). In Russian. English translation in : Soviet Astron.—AJ (New York), Vol. 2, No. 4, 610-11 (July-Aug., 1958).

For $n_e \cong 10^2$ to 10^3 cm^{-3} and $T \cong 10^4$, the concentration of neutral hydrogen in interplanetary space ($r \leq 1$ AU) is $n_H \cong 1$ to 10 cm^{-3}. The optical thickness of the interplantary gas between the sun and the earth in the Lα-line is great. A reversal with a width of about 0.1 A should originate in the centre of Lα.

523.162

10504. DETERMINATION OF THE CONSTANT PARAMETERS IN THE DEPENDENCE OF THE COSMIC ABSORPTION COEFFICIENT ON WAVELENGTH. A.F.Torongdzhadze.
Astron. Zh., Vol. 35, No. 6, 848-57 (1958). In Russian.

The light absorption coefficient K, as used in astrophysics, is a function of wavelength λ: $K = C_0 + C_1/\lambda^\alpha$, where C_0 and C_1 are constants and α may be a function of λ. The author calculates values of α to fit experimental data, and concludes that, unless $\alpha(\lambda)$ is known, it is preferable to use a set of numerical values of K corresponding to various wavelengths, instead of $K(\lambda)$ as a function of λ and α.

523.162 : 535.345

10505. LIGHT ABSORPTION IN A MIXTURE OF NEGATIVE IONS O^-_2, H^- AND O^-. O.L.Vaisberg.
Astron. Zh., Vol. 35, No. 6, 931-2 (1958). In Russian.

The distribution of light absorption in different mixtures of negative ions is given. Negative ions of molecular oxygen with a small admixture of negative ions of atomic hydrogen give the best explanation of the observed interstellar light absorption.

523.164 : 621.396.94

10506. A NEW RADIO-TELESCOPE OF HIGH RESOLVING POWER. S.É.Khaikin and N.L.Kaidanovskii.
Pribory i Tekh. Eksper., 1959, No. 2, 19-24 (March-April). In Russian.

The reflector of the telescope consists of plane elements touching the surface of an imaginary paraboloid with its axis direct at the point of observation, where the points of contact lie in a horizontal plane, passing through the focus of the paraboloid. Accuracy is achieved by the accurate disposition of the elements. The reflector transforms a plane wave into a cylindrical one with a vertical axis which is then transformed into a spherical wave by a secondary mirror — a parabolic cylinder. The horizontal and vertical dimensions of the telescope constructed were 120 m and 3 m respectively, giving at 3 cm. a beam width to half power points of $1.2' \times 1^0$ for small position angles. For centimetre wavelengths the area of the reflector should be of the order of 10^4-10^5 sq. m. The telescope is described in detail and some results of observations of the sun are added.
G.A.Chisnal

523.164 : 621.396.94

10507. TUNING A LARGE RADIO-TELESCOPE. N.A.Esepkina.
Pribory i Tekh. Eksper., 1959, No. 2, 24-6 (March-April). In Russian.

An experimental verification of a method suggested by the auth (Abstr. 9496 of 1957). The influence of different kinds of inaccuracies of the surface of the antennae on their characteristics is also investigated.
G.A.Chisna

523.164.3 : 551.510.5

RADIO REFLECTIONS FROM THE MOON AND SOLAR CORONA. See Abstr. 10418

523.164.3

10508. LINEAR POLARIZATION IN TYPE III BURSTS. M.H.Cob
Astrophys. J., Vol. 130, No. 1, 221-7 (July, 1959).

Six Type III and one Type V solar bursts have been seen which have some linear or elliptical polarization, in a 10 kc/s band at 200 Mc/s. Two of them are about 30% polarized and yield Faraday rotations less than 2×10^4 rad.

523.164.3

10509. OBSERVATIONS OF THE TOTAL SOLAR ECLIPSE OF JUNE 30, 1954, AT MILLIMETER WAVELENGTHS. A.E.Salomonovich, Yu.N.Pariiskii and U.V.Khangil'din.
Astron. Zh., Vol. 35, No. 4, 659-61 (1958). In Russian. English translation in : Soviet Astron.—AJ (New York), Vol. 2, No. 4, 612-14 (July-Aug., 1958).

The results of observations of solar radio emission at millimeter wavelengths during the eclipse of June 30, 1954, are given. The reduction of the eclipse curve permitted the estimation of the height of the effective emitting layer above the photosphere (6×10^3 km ± 30%) and the distribution of radio brightness on the solar disk.

523.164.

10510. SOLAR ACTIVITY AND THE BRAKING OF EARTH SATELLITES. W.Priester.
Naturwissenschaften, Vol. 46, No. 6, 197-8 (1959). In German.

A remarkable correlation is established for the period, November 1957 to February 1958, between the observed fluctuatio in the orbital rotation period of earth-satellite 1957β, and the variation of solar radio-flux on 20 cm wavelength.
D.R.Barb

523.164.

10511. RADIOASTRONOMICAL MEASUREMENTS ON THE SUN WITH SPECIAL REFERENCE TO THE EVENTS DURING CHROMOSPHERIC ERUPTIONS. O.Hachenberg.
Naturwissenschaften, Vol. 46, No. 9, 295-303 (1959). In German.

A review article covering the subject in a general way.
H.J.A.Chiver

523.164.32 : 550.3

10512. ON THE POWER SPECTRUM OF SOLAR RADIO OUTBURST AND ITS RELATION TO S.W.F. (DELLINGER PHENOMENON) AND GEOMAGNETIC STORM. Y.Hakura.
J. Radio Res. Lab. (Tokyo), Vol. 5, 283-93 (Oct., 1958).

The relation of solar eruptions to S.W.F.'s (short wave fades and geomagnetic storms was investigated in connection with the three types of power spectrum of solar radio outbursts on frequer cies between 200 and 9400 Mc/s. As far as large outbursts are concerned: (1) an eruption with solar radio outbursts whose powe spectrum is increasing towards lower frequencies tends to cause

Sc-type magnetic storm, while it has little relation to S.W.F. (magnetic storm type); (2) on the other hand, an eruption with outbursts whose power spectrum is increasing towards higher frequencies almost always causes S.W.F., but has no appreciable relation to a magnetic storm (S.W.F. type); (3) an eruption which has a flat power spectrum shows a combining effect of both the types mentioned above, and tends to produce both S.W.F. and magnetic storms (combining type).

523.164.32 : 550.385

10513. CHARACTERISTICS OF SOLAR OUTBURSTS TO EXCITE GEOMAGNETIC STORMS. K.Sinno.
J. Radio Res. Lab. (Tokyo), Vol. 6, No. 23, 17-20 (Jan., 1959).

Relations between the variation of solar radio outbursts on 200 Mc/s and geomagnetic storms are examined and the following conclusions are formed. Major outbursts which have a pronounced first part before the time of maximum flares, are closely related with short wave fade, and a large second part (ordinarily corresponding to type IV in spectral observation) corresponds to geomagnetic storms. From the latter results, it is concluded that the second part of major radio outbursts is direct evidence for the existence of a corpuscular cloud which will cause a geomagnetic storm.

523.164.4

10514. A MAP OF THE CYGNUS REGION AT 915 MEGACYCLES PER SECOND. J.J.Eaton and J.D.Kraus.
Astrophys. J., Vol. 129, No. 2, 282-6 (March, 1959).

Results are presented of observations made at 915 Mc/s with the 40 ft paraboloid of the Ohio State University Radio Observatory during the spring of 1957. Equipment characteristics are given, and a map of radio brightness temperature is shown which covers the region between 18^h and 24^h right ascension and between 24° and 60° north declination. A table lists 24 map features which appear to be discrete sources. These include Cygnus A, B, and X, Cassiopeia A, and the North American and Network nebulae.

523.164.4

10515. A HIGH-RESOLUTION SURVEY OF THE ANDROMEDA NEBULA AT 408 Mc/s.
M.I.Large, D.S.Mathewson and C.G.T.Haslam.
Nature (London), Vol. 183, 1250-1 (May 2, 1959).

A short account of a detailed survey using the 250 ft radio telescope at Jodrell Bank. The most interesting features of the survey are the prominent extensions in the corona which are directed away from the major axis of the nebula. It is suggested that these extensions are related to similar but rather weaker extensions observed in the emission from the Galaxy and that they may be generated by a synchrotron mechanism. The disk component of the radiation is also clearly resolved, and appears to arise mainly in a source of angular diameter less than 35 min of arc, contributing about 6% of the total radiation from the nebula. C.Hazard

523.164.4 : 523.8

EXPLORATION OF THE NEARBY GALAXIES BY OPTICAL AND RADIO METHODS. See Abstr. 9159

523.164.4 : 551.510.535

OBSERVATIONS ON GALACTIC RADIATION AT 30 Mc/s. See Abstr. 10419

523.164.42

10516. ON THE DISTANCE OF THE CASSIOPEIA RADIO SOURCE. G.Münch and L.Münch.
Astrophys. J., Vol. 129, No. 3, 854-6 (May, 1959).

The previous optical and radio measures of the distance of the Cassiopeia A radio sources give conflicting results. The distance of a star in the field covered by the source was measured to be about 1.7 kiloparsec as derived from observations of colour excess. These results support the radio determination of the distance of the source. R.D.Davies

523.164.42

10517. POLARIZATION OF THE CASSIOPEIA RADIO SOURCE. W.A.Hiltner.
Astrophys. J., Vol. 129, No. 3, 856-8 (May, 1959).

Photoelectric measurements were made of the polarization of a bright filament in the Cassiopeia radio source, and compared with similar observations of nearby stars. No significant intrinsic polarization of the filament was observed when using a 15' arc diaphragm. R.D.Davies

523.164.43 : 535.34

CONTINUOUS ABSORPTION COEFFICIENT FOR FREE–FREE EMISSION. See Abstr. 9410

523.164.85

10518. THE INFLUENCE OF THE METEOR VELOCITIES ON THE HOUR NUMBER DURING RADIO DETECTION. F.I.Peregudov.
Astron. Zh., Vol. 35, No. 6, 888-92 (1958). In Russian.

The influence of the velocity of flight of a meteor on the value of its effective scattering surface is investigated. This allows a relation between the hour number and meteor velocities to be established and a more precise determination of the dependence the hour number on the wavelength of the radio-echo station.

523.3 : 526

10519. ON THE USE OF OBSERVATIONS OF THE MOON FOR GEODETIC PURPOSES. Kh. I. Potter.
Astron. Zh., Vol. 35, No. 4, 618-22 (1958). In Russian. English translation in : Soviet Astron.—AJ (New York), Vol. 2, No. 4, 573-7 (July-Aug., 1958).

The possibility of finding the corrections $\Delta\rho$, $\Delta\varphi'$, $\Delta\lambda$ to the geocentric coordinates of the point of observation and the corrections $\Delta\alpha$, $\Delta\delta$, $\Delta\pi$ to the coordinates of the moon from photographic observations of the moon is investigated. The analysis of the equations determining the solution of the problem shows that only four of the six unknowns can be determined independently: $\Delta\alpha$, $\Delta\lambda$, and the two quantities u and v which are linear combinations of the other unknowns.

523.37

10520. LUNAR RAYS: THEIR FORMATION AND AGE. L.A.Giamboni.
Astrophys. J., Vol. 130, No. 1, 324-35 (July, 1959).

The nature of the rays of Tycho and Copernicus suggests that they were laid down at a time when the angular velocity of the moon was markedly different from that observed today. The rays of Tycho indicate that the lunar sidereal period was between 0.5 and 6.8 days and that the poles were in approximately the same position then as they are today. These rays were created within 8×10^7 years of the time the moon was formed. The rays of Copernicus support these observations and indicate that the rotation of the moon at the time that these rays were formed was similar to the rotation which existed at the time that Tycho was formed.

523.66

10521. THE NONSTATIONARY DISTRIBUTION OF APPARENT DENSITY IN COMETS. D.O.Mokhnach.
Astron. Zh., Vol. 35, No. 4, 605-17 (1958). In Russian. English translation in: Soviet Astron.—AJ (New York), Vol. 2, No. 4, 560-72 (July-Aug., 1958).

Formulae for calculating the apparent density in the head of a comet at various times after the beginning of isotropic emission are derived in three cases: (1) in the absence of an external field of force, (2) in the presence of a uniform field of repulsive forces, (3) in the presence of a uniform field of external forces with a subsequent photoionization of molecules, leading to a change in the effective acceleration and radiation capacity of the molecules. It is shown that the law $N(x,y) \cong r^{-1}$ possess great generality. With present-day observational precision it is impossible to distinguish between stationary and nonstationary distributions of apparent density, and also between first and second varieties of isotropic emission. The formation of a gaseous tail is possible only in the third of the cases inder investigation, i.e. in the case of photoionization of molecules and an external field of repulsive forces. Taking the comet 1942 g as an example, it is shown that observational data are not contradicted by the following values of the physical parameters: initial velocity $v_0 = 4 \times 10^5$ cm/sec, acceleration of a neutral molecule g = 0.2, acceleration of an ionized molecule $g_+ = 1.0$, time of ionization $T = 45 \times 10^5$ sec, ratio of the radiation capacity of ionized and neutral molecules $n^+/n = 20$. Views are expressed on the possibility of determining the physical parameters of comets from the form of the isophotes.

523.7

10522. MODERN SOLAR OBSERVATION. H.H.Voigt.
Naturwissenschaften, Vol. 46, No. 6, 195-7 (1959). In German.

A review article on recent ground-based, or rocket observations concerned with the contributions made by photosphere, chromosphere and corona to solar radiation in X-ray, ultraviolet, infrared, and radio spectral regions. Recent results obtained in each waveband are mentioned, and account is taken of the effects of selective absorption by certain terrestrial atmospheric gases. D.B.Barber

523.7

10523. SOLAR AND INTERPLANETARY MAGNETIC FIELD. II. POLAR RAYS AND THE GENERAL MAGNETIC FIELD.
H.Shimooda.
Publ. Astron. Soc. Japan, Vol. 10, No. 3, 107-19 (1958).

For Pt I, see Publ. Astron. Soc. Japan, Vol. 8, No. 3-4, 95-107 (1956). Stationary forms of polar rays at the eclipses of 1954 and 1955 are traced by means of a sine approximation from observational data. The orthogonal curves to polar rays between 1.1 $R_\odot$ and 1.5 $R_\odot$ may be expressed by

$$\frac{x^2}{\alpha^2} + \frac{(y - \beta \coth \xi)^2}{\beta^2} = \operatorname{csch}^2 \xi,$$

where x and y denote the magnetic equator and axis, respectively, and α, β and ξ are three parameters. The magnetic poles may be found from this formula ($\xi \to \pm\infty$). It is found that the solar general magnetic field is different from that of a magnetic dipole and also from that of a schematic magnet. It is proposed that the solar corona remains in hydrostatic equilibrium under the interaction of the coronal material with the general field, and also that the field there may be force-free. The magnetic lines of force of the general field are hydromagnetically investigated and are found to be represented by

$$r^{1/2} J_{n+3/2}(\alpha_k r)(1 - \mu^2) C_n^{3/2}(\mu) = \text{constant},$$

where $J_{n+3/2}(\alpha_k r)$ is a Bessel function of n + 3/2 order, $C_n^{3/2}(\mu)$ is a Gegenbaur polynomial and $\mu = \cos\theta$. Polar distance and the lowest mode of this formula are compared with the stationary forms of polar rays. The electron densities in and between polar rays are briefly discussed and a criterion for the general magnetic field is briefly stated.

523.72

10524. AN EVOLUTIONARY SEQUENCE OF SOLAR MODELS.
R.L.Sears.
Astrophys. J., Vol. 129, No. 2, 489-95 (March, 1959).

A sequence of solar models was computed, covering 4.5×10^9 years at intervals of 1.5×10^9 years. The initial composition and extent of convective envelope were partially fixed with reference to the age-zero main sequence of Sandage (1957). It is found that the decrease in hydrogen content at the centre is 33% and the increase in total luminosity is 42% in the assumed time interval. An inhomogeneous model with a single 4.5×10^9 year time step is found to differ little from the last model of the sequence, thus strengthening the work of Schwarzschild, Howard and Harm (1957) and Weymann (1957). Revised interpolation formulae for the opacity and energy generation are used.

523.74

10525. TURBULENT MOTION IN THE SOLAR ATMOSPHERE. I. DOPPLER WIDTHS OF PHOTOSPHERIC LINES. W.Unno.
Astrophys. J., Vol. 129, No. 2, 375-87 (March, 1959).

The method proposed by Goldberg (1958) is applied to twenty-five pairs of multiplet lines of moderate intensity in order to determine Doppler widths in various optical depths in the solar photosphere at the centre of the disk of the sun. The turbulent velocity is found to decrease with height. The derived velocities are 1.55, 1.08, and 0.75 km/sec, corresponding to the optical depths 0.6, 0.4, and 0.2 at λ5000 A.

523.74

10526. TURBULENT MOTION IN THE SOLAR ATMOSPHERE. II. TURBULENT VELOCITIES IN THE LOWER CHROMOSPHERE. W.Unno.
Astrophys. J., Vol. 129, No. 2, 388-400 (March, 1959).

Eight pairs of strong multiplet lines are measured and used for the determination of Doppler widths by means of Goldberg's method (1958). The resultant Doppler widths are corrected for the effect of non-coherent scattering. The turbulent velocity is found to increase with height: it is about 1.9 and 3.5 km/sec at the height of 500 and 1000 km above the base of the chromosphere, respectively; and its variation is found to be approximately inversely proportional to the one-fourth power of the density. From this it is concluded that the chromospheric turbulence is due to the acoustic noise scattered by the inhomogeneous structure of the chromosphere; and the energy transport to the corona by this acoustic noise is found to be just sufficient to balance the total radiation energy emitted from the corona.

523.74

10527. THE DISTRIBUTION OF ELECTRON PRESSURE IN THE SOLAR PHOTOSPHERE. W.E.Mitchell, Jr.
Astrophys. J., Vol. 129, No. 2, 369-74 (March, 1959).

In this paper a hydrostatic model of the solar photosphere is integrated in monochromatic optical depth at three infrared wavelengths, utilizing a recent determination of the metals abundance, log A = 4.28. In the line-forming region the electron pressure is lowered approximately 50% with respect to that in the modified Aller–Pierce model. There is good agreement between the models at λ 8000 and λ 11 000 and the model at λ 16 000. Consequently, the present theoretical values for the free–free contribution to the negative hydrogen-ion absorption are probably not in error by any significant amount.

523.74

10528. THE VELOCITY SPECTRUM OF CORPUSCLES IN SOLAR CORPUSCULAR STREAMS. É.R.Mustel' and O.N.Mitropol'skaya.
Astron. Zh., Vol. 36, No. 1, 5-16 (1959). In Russian.

The velocity spectrum of corpuscules ejected from plages was studied for the period 1951-1953, the previous connections of plages with geomagnetic activity being revised.

523.745 : 551.510.53

SOLAR ACTIVITY EFFECTS ON F2 REGION DRIFTS. See Abstr. 10414

523.746

10529. ON THE GENERATION OF CORPUSCULAR STREAMS BY MAGNETIC FIELDS OF SUNSPOTS. P.E.Kolpakov.
Astron. Zh., Vol. 36, No. 1, 65-72 (1959). In Russian.

The possibility of generating corpuscular streams in a non-uniform magnetic field of a unipolar group of sunspots, which increases with time, is considered and it is shown that the most rapid particles of the coronal-chromospheric plasma will acquire energy from the action of the induced electric field. These particle will rise upwards and can escape as a beam of particles with energy $\sim 4 \times 10^5$ eV. P.Romar

523.74

10530. A STUDY OF THE [DISTRIBUTION] FIELD OF EVERSHEI VELOCITIES IN A SUNSPOT. R.Servajean.
C.R. Acad. Sci. (Paris), Vol. 248, No. 14, 2071-3 (April 6, 1959). In French.

Based on line measures of 310 spectra of a sunspot obtained at Meudon during its disk passage, 23 April-5 May, 1958, variations o the Evershed velocity components in the penumbra, and the adjacen photosphere, show the presence of a centre-limb effect that is related to the variation of the Evershed effect with optical depth already reported [C.R. Acad. Sci. (Paris), Vol. 246, No. 8, 1158-9, (1958)]. D.R.Barbe

523.746 : 551.510.53

10531. SOLAR ACTIVITY CYCLE AND SPREAD F. G.Reber.
J.geophys. Res., Vol. 63, No. 4, 869 (Dec., 1958).

The occurrence of spread F over Hawaii since 1954 has close repeated features of the previous sunspot cycle, passing through a minimum during the winter of 1957-58. It is suggested that spread F might provide a sensitive and rapid manner of estimating solar activity extremes. G.M.Brow

523.74

10532. SPICULES ON THE SOLAR DISK. A.Bruzek.
Z. Astrophys., Vol. 47, No. 3, 191-7 (1959). In German.

The properties of the dark mottles which are seen on Hα-filter grams of high definition are studied. It is found that there are abou 15 000 mottles on the whole (undisturbed) sun with diameters from 2000 to 5500 km and a mean lifetime of 10 min. Doppler shifts corresponding to velocities up to 50 km/sec are observed. Near th sun's limb the mottles are stretched up to a length of 8000 to 12 000 km. The results strongly favour the identification of the mottles with the spicules observed at the sun's limb.

523.7

10533. PHYSICAL CONDITIONS IN LIMB FLARES AND ACTIVE PROMINENCES. I. THE LOOP PROMINENCES OF NOVEMBER 12 AND 22, 1956. E.Tandberg-Hanssen and H.Zirin.
Astrophys. J., Vol. 129, No. 2, 408-13 (March, 1959).

Spectra of two bright, flarelike loop prominences have been analysed; it is found that the emission lines (in particular Hβ, Hγ,

He I 4713 and He II 4686) have profiles closely fitted by a Gaussian istribution of intensity. The measured line widths, however, show ifferent temperatures for the different atoms. The neutral helium ines are more than half as broad as the hydrogen lines, and the He II line is much broader than the He I lines. It is necessary to onclude that the lines originate in intertwined regions of different emperatures. Relative mass motions of the order of 70 km/sec ere measured between different branches of one of the prominences.

523.75

10534. PHYSICAL CONDITIONS IN LIMB FLARES AND ACTIVE ROMINENCES. II. A REMARKABLE LIMB FLARE, DECEMBER 8, 1956. H.Zirin.
strophys. J., Vol. 129, No. 2, 414-23 (March, 1959).

Spectra of a bright limb flare show many lines of metals, ydrogen, and helium. The temperature in the flare, as deduced rom line broadening, is in the range 50 000°-100 000°. Relative ne intensities also indicate high temperatures. The coronal lines 4086 (Ca XIII) and λ 5694 (Ca XV) are strongly enhanced during he flare. From the behaviour of both lines it is concluded that 5694 is surely due to Ca XV. Continuous emission from a dense oronal cloud was observed just before the flare. This cloud ondenses sharply during the flare and dissipates afterward. The ontinuous emission from the flare appears due to electron scatter-ng.

523.75

10535. PHYSICAL CONDITIONS IN LIMB FLARES AND ACTIVE ROMINENCES. III. THE DIFFERENCE BETWEEN THE SURGE ND LOOP PROMINENCES OF DECEMBER 19, 1956.
.Tandberg-Hanssen.
strophys. J., Vol. 130, No. 1, 202-14 (July, 1959).

Spectra of a bright loop prominence and of two bright surges ere analysed, and relative line intensities indicate high-excitation onditions. The line widths indicate regions of different tempera-ures in the prominences. Since the observations cannot be inter-reted in terms of one region with a single temperature and turbu-nt velocity, a possible interpretation is that the prominences con-ist of distinct domains, characterized by emissions from ionized elium, hydrogen, neutral helium, and metals, respectively. The oop seems to be intimately connected with the hot corona, where everal coronal lines are observed, while the intrinsically brighter urges fade rapidly as they move into coronal regions. Spectra of he corona above the loop show the rare λ 4086 and λ 5445 coronal nes.

523.75

10536. NON-STATIONARY PROCESSES IN SOLAR FLARES AS PINCH EFFECT. A.B.Severnyi.
stron. Zh., Vol. 35, No. 3, 335-50 (1958). In Russian.

A detailed discussion of the spectroscopy of solar flares and houstaches confirms earlier conclusions of the author (1957). hotoelectric investigations, made with the Crimean Astrophysical bservatory solar magnetograph, show that (1) flares appear in neu-al points of the magnetic field of sunspots when the gradient of eld strength is sufficiently large in the vicinity of such points; (2) he appearance of flares leads to the destruction of the surrounding agnetic field. It is shown that instability of the plasma sets in hen the concentration of lines of force around the neutral point is fficiently high. The plasma can contract without limit (pinch ffect). The time of contraction is comparable with the observed me of the flash phase. Powerful macroscopic motions with veloci-es greater than 100 km/sec and heating of the plasma up to 10^{7}°K re caused by the collision of two shock waves at the neutral point. number of observed phenomena can be explained by this process.
G.A.Chisnall

523.75

10537. RADIO PATROL OF SOLAR FLARES.
.P.Mitra, K.A.Sarada, N.V.G.Sarma and M.N.Joshi.
sci. industr. Res., Vol. 17A, No. 12 (Suppl.), 74-80 (Dec., 1958).

Flare patrol measurements have been made at the National hysical Laboratory, New Delhi, using as criteria of a solar flare vent: (1) sudden enhancement of intensity of atmospherics at 27 nd 100 kc/s; (2) sudden increase in ionospheric absorption of alactic radiowaves at 22.4 and 30 Mc/s; and (3) minimum critical requency of reflection from ionosphere for the frequency band, -25 Mc/s. It is found that (3) is increased during intense flares, he variation with time following approximately that of the Hα flare mission.
D.R.Barber

523.752 : 539.18

10538. THE HIGH-TEMPERATURE EXCITATION OF IONIZED HELIUM. J.B.Zirker.
Astrophys. J., Vol. 129, No. 2, 424-31 (March, 1959).

Calculations are presented for the excitation and ionization of He II in atmospheres which depart from local thermodynamic equilibrium. Lyman-α of hydrogen may strongly influence the observed intensity of λ 4686 of He II. The temperature in the helium-emitting regions of the solar chromosphere may range from 2.5×10^{4} to 4×10^{4}, depending upon the importance of the coupling of H and He II in Lyman-α.

523.755

10539. VELOCITY FIELDS IN A CORONAL REGION WITH A POSSIBLE HYDROMAGNETIC INTERPRETATION. D.E.Billings.
Astrophys. J., Vol. 130, No. 1, 215-20 (July, 1959).

The distribution of λ 5303 half-widths in a coronal region shows an oscillatory pattern. This pattern and the correlated gross Doppler displacements of the line, may arise from a transverse hydro-magnetic wave in the corona. Longitudinal hydromagnetic waves are also considered, but they appear less consistent with observations than transverse waves. Magnetic field perturbations of 0.05 gauss in a 1 gauss field are adequate to explain the pattern.

523.76

10540. OBSERVATIONS OF SOLAR MAGNETIC FIELDS.
R.Howard.
Astrophys. J., Vol. 130, No. 1, 193-201 (July, 1959).

The magnetograph at the 150 ft solar tower at Mount Wilson Observatory was used to trace a number of active and quiet regions on the surface of the sun with an angular resolution of about 10 sec of arc. It was found that magnetic features exist near sunspots with fields exceeding 75 gauss. Changes in the magnetic features, as seen from magnetic contour maps made on different days, were fre-quent. The flux measured near spots was in most cases sufficient to balance the flux from the spots. There is good evidence for a tilting of the lines of force of the photospheric magnetic field in the direc-tion of a sunspot. Magnetic contour maps show that magnetic fea-tures bear a close resemblance to calcium-plage regions. In all cases the plages were outlined very nearly by a 10 gauss contour line. Where filaments (prominences) were present in regions re-moved from plages, in all cases it was found that they occurred in areas where the field was less than 10 gauss. Moreover, the mag-netic features on either side of the filaments were always of differ-ent polarities. It is suggested that the magnetic field in the solar photosphere and chromosphere is in the form of more or less vert-ical columns.

523.77

10541. VARIATIONS OF TWO SODIUM DOUBLETS ALONG A RADIUS OF THE SOLAR DISK. M.Rigutti.
Mem. Soc. Astron. Ital., Vol. 30, No. 1-2, 121-34 (1959).

The variations were measured at 8 different points along a radius. In accord with earlier results, it is inferred that the Na absorption lines are probably formed in the low chromosphere, or within the layers at the boundaries of the photosphere and chromos-pere.

523.84

10542. STANDARD LIGHT-TIME CURVES. J.B.Irwin.
Astron. J., Vol. 64, No. 4, 149-55 (May, 1959).

The apparent variation of period of an eclipsing binary arising from the variation of distance (changing light-time) from the obser-ver, as the result of orbital motion with respect to a third compon-ent, produces a characteristic curve whose shape depends only on e and ω. Coordinates for a complete set of standard light-time curves are given that should prove useful in a preliminary analysis of variation of period. Analytical expressions for the least-squares coefficients are given.

523.85

10543. A CASE OF DOUBLY PERTURBED STELLAR MOTIONS. P.Bouvier.
Arch. Sci. (Geneva), Vol. 11, No. 4, 493-9 (Oct.-Dec., 1958).
In French.

The motion of a star in a cluster is considered in the presence of perturbations arising from the gravitational field of a neighbouring cloud of interstellar matter and from the general galactic field. The centres of the cloud and cluster are taken to be in the galactic plane.
R.A.Newing

523.852

10544. THE CRAB AND CYGNUS A AS GAMMA RAY SOURCES. M.P.Savedoff.
Nuovo Cimento, Vol. 13, No. 1, 12-18 (July 1, 1959).

The Crab is estimated to give a maximum nuclear γ-ray flux of 10^{-2} cm^{-2} sec^{-1} from the decay of Cf^{251} formed with Cf^{253} during the supernova outburst. Although extrapolation of the radio and visual fluxes suggests the possibility of a flux as high as 10 γ cm^{-2} sec^{-1} between 1 and 2 MeV, model calculations suggest that 7×10^{-5} γ cm^{-2} sec^{-1} above about 10 MeV is more probable. Bremsstrahlung and Compton scattering yield considerably lower fluxes. Cygnus A, regarded as the result of a collision of matter and antimatter, should yield lower fluxes than the γ cm^{-2} sec^{-1} estimated by Morrison. The radio flux suggests a π^0 decay γ-flux of 4×10^{-5} γ cm^{-2} sec^{-1}. For E > 10 MeV, any γ-ray flux exceeding 5×10^{-5} γ cm^{-2} sec^{-1} should be detectable from a balloon-flown emulsion stack.

523.874

10545. THE FORMATION OF FORBIDDEN LINES IN THE OUT-FLOWING ENVELOPES. M.Kanno, S.Kawabata and T.Kogure.
Publ. Astron. Soc. Japan, Vol. 10, No. 3, 129-37 (1958).

The non-appearance of forbidden lines in WR spectra was pointed out by Vorontzov-Velyaminov (1957) as an objection to Beals' hypothesis of outflow of matter (1930). In this paper, the intensities of forbidden lines relative to permitted ones are calculated from Beals' hypothesis, and the possible appearance of forbidden lines is considered. Results favouring Vorontzov-Velyaminov's objection are obtained in the case of a model envelope, where the electron temperature is assumed to be equal to the effective temperature of the star. But when the electron temperature is reduced considerably by some cooling processes, relative intensities decrease appreciably. The visibility of nebulosity surrounding the star is also discussed.

523.877

10546. PARTICLE TRAJECTORIES AROUND CLOSE BINARY SYSTEMS. N.L.Gould.
Astron. J., Vol. 64, No. 4, 136-9 (May, 1959).

The differential equations of motion for the restricted three-body problem have been integrated numerically to give the path (in a rotating frame of reference) of a particle ejected radially from one component of a close double star system. This has been done for several mass ratios and initial positions and velocities. The most usual results are a ring around one component rotating in a forward direction, or for higher velocities, a ring around both components rotating in a retrograde direction. A particle ejected from the first Lagrangian point will form an orbit only if the mass of the star from which it is ejected is approximately one-fifth or less that of its companion.

523.877

10547. STABILITY OF MAGNETIC STARS IN A DECAY FIELD. S.P.Talwar.
Indian J. Phys., Vol. 32, No. 5, 230-40 (May, 1958).

The stability of a magnetic star in a slowly decaying axially symmetric magnetic field is investigated. Poloidal and toroidal fields are considered and the initial magnetic energies evaluated. From the condition of dynamical stability the expression for the critical primitive magnetic fields which can exist in the star is worked out. The magnetic energies and the critical fields for instability are tabulated. Further, the effect of a magnetic field, toroidal as well as poloidal (less than the critical), on the equilibrium of a sphere of constant conductivity is investigated. It is found that the sphere is not an equilibrium form and tends to deform into a spheroidal shape. The effect of a toroidal field is to turn it into a prolate spheroidal shape, whereas in a poloidal field the sphere has a tendency to become an oblate spheroid of small ellipticity. The expressions for the ellipticity of the spheroidal form are worked out in each case.

525.3

10548. EFFECTS OF THE EARTH'S OBLATENESS ON THE ORBIT OF AN ARTIFICIAL SATELLITE. A.De Moraes.
An. Acad. Brasil. Cienc., Vol. 30, No. 4, 465-510 (1958).

A detailed mathematical treatment of the perturbing effect of the earth's polar oblateness on the orbit of a satellite circling close to the earth. The potential energy of a particle in the gravitational field of an oblate spheroid of revolution is expressed as a series of odd powers of 1/r (r = radius vector), of which the first term (in 1/r) corresponds to a simple spherical earth made up of homogeneous layers, giving an elliptical orbit according to Kepler's laws. The other terms (in $1/r^3$ and $1/r^5$) represent respectively first and second order effects of oblateness. Perturbations of r, displacements of the nodal and apsidal lines, and variations of the inclination with latitude arising from the oblateness terms are discussed, and some of the theoretical results obtained are compared with experimental observations of recent satellites. It is shown that the relativistic displacement of the perigee of an earth satellite is comparable to a third order effect of oblateness. G.M.Brown

525.

10549. THE TRANSFORMATION OF RECTANGULAR SPACE COORDINATES ON THE EARTH'S ELLIPSOID. I.G.Letoval'tsey.
Astron. Zh., Vol. 35, No. 4, 627-33 (1958). In Russian. English translation in : Soviet Astron.—AJ (New York), Vol. 2, No. 4, 582-8 (July-Aug., 1958).

In order to fix the position of moving objects in space (rockets, artificial satellites) relative to the earth, it is necessary to have a system of space coordinates. The most convenient for this purpose is a rectangular system of coordinates, the normal to the earth's ellipsoid serving as the y axis. The direction of the x axis is determined by the geodetic azimuth and the z axis completes the system to a right-handed one. In this paper a solution for the transformation of such a system with an origin at some point on the earth determined by geodetic coordinates (latitude B_1, longitude L_1), into another system with an origin at another arbitrarily remote point on the earth, determined by the geodetic coordinates B_2 and L_2, is given. As during practical measurements on the earth's surface the instruments are orientated by the plumb line and not by the normal to the ellipsoid, the problem is solved taking into account the deviation of the plumb line and also the altitude of the point of observation above the surface of the adopted ellipsoid.

525.3 : 550.31

DETERMINATION OF THE EARTH'S GRAVITATIONAL POTENTIAL FROM OBSERVATIONS ON SPUTNIK 2 (1957β).
See Abstr. 10406

525.3 : 535.3

LUMINOUS INTENSITY OF REFLECTING SATELLITE.
See Abstr. 9499

529.

10550. INEQUALITIES IN MEAN SOLAR TIME FROM TIDAL VARIATIONS IN THE ROTATION OF THE EARTH. E.W.Woolard.
Astron. J., Vol. 64, No. 4, 140-2 (May, 1959).

The deformation of the earth by the luni-solar tide-generating forces alters the moments of inertia of the earth and thereby causes periodic variations in the rate of rotation, which introduce inequalities in the measure of time determined by the rotation. The cumulative effects of the larger long-period components with periods up to one year have been detected by observation with the aid of accurate clocks. All long-period inequalities with amplitudes as great as 0.10 millisecond are computed, and are listed.

529.786 : 621.373.

10551. REPORT ON THE PRECISION OF ATOMIC STANDARDS OF FREQUENCY. L.Essen.
Astron. J., Vol. 64, No. 3, 120-3 (April, 1959).

Atomic frequency standards have been checked by laboratory investigations and by the intercomparison of different standards. Existing ammonia masers enable a frequency to be defined in terms of a spectral line with an accuracy of ±1 part in 10^8 and give a reproducibility under stated conditions of ±2 parts in 10^{10}. The caesium atomic beam standard enables a frequency to be defined in terms of a spectral line with a precision of ±1 part in 10^{10}. Comparison between the U.K. and U.S. by the radio transmissions of standard frequencies and time signals gave an average agreement of a few parts in 10^{10} but revealed some systematic discrepancies. Direct comparisons between three U.S. standards and the U.K. standard gave agreement to 2.2, 3.2, and 1.5 parts in 10^{10}.

529.786 : 539.19 : 621.317.361

10552. CONSIDERATIONS ON THE DESIGN OF A MOLECULAR FREQUENCY STANDARD BASED ON THE MOLECULAR BEAM ELECTRIC RESONANCE METHOD. V.W.Hughes.
Rev. sci. Instrum., Vol. 30, No. 8, 689-93 (Aug., 1959).

The use of a rotational state transition as observed by the molecular beam electric resonance method is discussed as a possible frequency standard particularly in the millimetre wavelength range. As a promising example the 100 kMc/s transition between J = 0 and J = 1 rotational states of Li^6F^{19} is considered. The relative insensitivity of the transition frequency to external electric and magnetic fields and the low microwave power requirements appear favourable; the small fraction of the molecular beam that is in a single rotational state is a limiting factor.

PHYSICS

GENERAL

53.087.6

0553. NOTES ON A MAGNETIC PEN KYMOGRAPH. R.M.Zilberstein.
Rev. sci. Instrum., Vol. 30, No. 6, 494-5 (June, 1959).

The pen used in ink recorders is replaced by a very small, pointed, ceramic, permanent magnet, and a standard $\frac{1}{2}$ in.wide magnetic tape substituted for the paper. The tape is run in contact with the magnet. The tape is developed in a suspension of black iron oxide (Fe_3O_4) in methanol until the trace becomes visible (~$\frac{1}{32}$ in. wide). C.F.Pizzey

530.1

0554. A MODEL FOR THE DEMONSTRATION OF THE EXPONENTIAL LAW. K.Hecht and A.Lindberg.
Naturwissenschaften, Vol. 46, No. 7, 223 (1959). In German.

An experiment has been designed to demonstrate the laws of exponential decay, exponential increment, and the rate of replenishment of an exponentially decaying source from another exponentially decaying source. For this purpose the flow of water at hydrostatic heads of less than 0.5 m through vertical tubes was sufficiently throttled for the Reynolds number to be so small that $-dh/dt = kh$, where k = a constant. Then, to show a logarithmic increment of hydrostatic head, water at constant rate of flow was fed to the discharging vertical tube, whereas in the third demonstration a logarithmically decaying stream of water was fed to the discharging tube. R.Schnurmann

530.1

0555. CODING AND INFORMATION THEORY. P.Elias.
Rev. mod. Phys., Vol. 31, No. 1, 221-6 (Jan., 1959).

An introduction, in non-mathematical terms, of "information theory" that is, the generation, storage, transmission and processing of information. Some possible applications to biology are mentioned. J.Iball

GRAVITATION . RELATIVITY

530.12

0556. THE VARIATIONAL PRINCIPLE OF RELATIVISTIC HYDRODYNAMICS. C.Jankiewicz.
Acta phys. Polon., Vol. 18, No. 1, 7-13 (1959). In German.

On the basis of the space deformation theory of Schouten and van Kampen, by the introduction of auxiliary functions, a variational principle for relativistic hydrodynamics is set up and illustrated by applications to ideal and viscous fluids. T.R.Carson

530.12

0557. ON THE CONNECTION BETWEEN THE EQUATIONS OF MOTION AND THE FIELD EQUATIONS. C.Jankiewicz.
Acta. phys. Polon., Vol. 18, No. 1, 21-35 (1959). In German.

By using Lie differentials it is shown that, in every classical generally relativistic field theory, the equations of motion of the continuously distributed field sources follow from the field equations. Furthermore, the equations of motion are identical with the conservation laws of the field. Gravitation theory and electrodynamics are quoted as examples. T.R.Carson

530.12

0558. ON THE EXISTENCE OF SINGULARITY-FREE SOLUTIONS TO THE FIELD EQUATIONS OF THE GENERAL THEORY OF RELATIVITY, WHICH CAN REPRESENT PARTIAL MODELS. A.Papapetrou and H.Treder.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 7-8, 360-72 (1959). In German.

The authors discuss the existence of such solutions, which are also periodic in time. Papapetrou has shown (Abstr. 7673 of 1958) that such solution can only exist in a finite inner region of three-dimensional space, where the gravitational field is strong, provided that it can be fitted to a stationary solution outside this region, over a common boundary surface. It is shown in this paper that such a surface cannot exist and therefore that no singularity-free solutions exist within a partial model. The discussion is finally extended to Einstein—Maxwell field equations for combined gravitational and electromagnetic fields. J.K.Skwirzynski

530.12

10559. MODELS AND MOTIONS OF CHARGED PARTICLES IN GENERAL RELATIVITY. J.Hély.
C.R. Acad. Sci. (Paris), Vol. 248, No. 21, 2962-4 (May 25, 1959). In French.

A metric is defined which describes a model universe characterized by a radial electric field. If the latter is taken to be that of a charged particle at rest, a special case, constituting a model for the particle, results. T.R.Carson

530.12

10560. ON THE PROPAGATION OF THE DISCONTINUITIES OF THE CURVATURE TENSOR IN EINSTEIN'S UNIFIED FIELD THEORY. Saiyid Izhar Husain.
C.R. Acad. Sci. (Paris), Vol. 248, No. 21, 2965-7 (May 25, 1959). In French.

530.12

10561. THE CONCEPTS OF MASS AND ENERGY IN THE GENERAL THEORY OF RELATIVITY. I. C.Møller.
K. Norske Vidensk. Selsk. Forhandl., Vol. 31, No. 13, 80-4 (1958; published 1959).

The equivalence of inertial and passive gravitational mass is purely empirical and not a basic assumption of Newtonian mechanics, but the law of action and reaction implies the equivalence of passive and active gravitational mass. The Newtonian concepts had to be modified in the special theory of relativity, which is concerned exclusively with inertial mass. The most important result of special relativity is the equivalence of mass and energy, but the rest mass of a compound system is not additive as in Newtonian mechanics. T.R.Carson

530.12

10562. THE CONCEPTS OF MASS AND ENERGY IN THE GENERAL THEORY OF RELATIVITY. II. C.Møller.
K. Norske Vidensk. Selsk. Forhandl., Vol. 31, No. 14, 85-91 (1958; publ. 1959).

In the general theory of relativity, the defects of the special theory, viz. restriction to inertial frames of reference and the neglect of gravitational phenomena, are removed by the principle of equivalence, which implies the equality of inertial and passive gravitational mass. All three types of mass are exactly equal for any closed system and the rest energy may be interpreted as the gravitational self-energy. T.R.Carson

530.12

10563. A POSSIBLE EXPERIMENTAL TEST OF EINSTEIN'S SECOND POSTULATE. H.Dingle.
Nature (London), Vol. 183, 1761 (June 20, 1959).

Of the two basic postulates of the special theory of relativity, namely, the relativity principle and the independence of the velocity of light on the state of motion of the emitter, the first has much experimental support while the latter has none. Experiments frequently held to confirm the kinematical aspects of the theory are, in fact, evidence of the Lorentz invariance of Maxwell's equations. T.R.Carson

530.12

10564. EFFECTS OF THE CENTRAL SPIN ON PLANETARY MOTION. A.Das.
Progr. theor. Phys., Vol. 17, No. 3, 373-82 (March, 1957).

The motion of spinning test-particles in the field of a spinning sphere is investigated. The bending of light rays is calculated, and the perturbing forces on the Newtonian elliptical orbit are determined.

530.12

10565. A COUNTERPART OF RELATIVITY THEORY AS AN EXTENDED LAGUERRE GEOMETRY. T.Takasu.
Proc. Japan Acad., Vol. 35, No. 2, 65-70 (Feb., 1959). In German.

The author's relativistic theory is formulated in terms of a non-holonomic Laguerre fibre-bundle geometry and is developed from a

principle of least action in a "space–time + momentum–potential field" manifold. The counterpart considered here is developed from a principle of least work in a "space–time + field force–potential time gradient" manifold, the variational principle defining lines of force. R.A.Newing

530.12

10566. SPECIAL-RELATIVISTIC EVALUATION OF A VARIANT OF PROJECTIVE RELATIVITY THEORY. E.Schmutzer.
Z. Naturforsch., Vol. 14a, No. 5-6, 486-8 (May-June, 1959). In German.

In order to understand better the physical content of projective relativity theory, whose field equations may only be solved with difficulty in certain cases, the theory is specialized to the case of a Minkowski space. The resulting field equations are equivalent to a nonlinear electrodynamics and therefore lead to the well-known nonlinear effects. In particular, the field energy of a charged-point singularity converges, in connection with which the gravitational constant enters into a certain "fundamental length". T.R.Carson

530.12

10567. SELF-INTERACTION OF THE ELECTROMAGNETIC WAVE-FIELD ACCORDING TO A NONLINEAR ELECTRODYNAMICS BASED ON A PROJECTIVE RELATIVITY THEORY. E.Schmutzer.
Z. Naturforsch., Vol. 14a, No. 5-6, 489-92 (May-June, 1959). In German.

Within the framework of a nonlinear electrodynamics, developed in the preceding abstract and which leads to a convergent field energy for a point singularity, the self-interaction of a free electromagnetic field is now investigated. An approximate solution of the field equations is found, which in the first approximation corresponds to the Maxwell theory. A definite spatial fluctuation of the field quantities of the interfering waves appears, characterized by a dimensionless factor, in which the gravitational constant, the frequency and the amplitude enter. T.R.Carson

530.12

10568. ZEMPLEN'S THEOREM IN RELATIVISTIC HYDRODYNAMICS. R.V.Polovin.
Zh. eksper. toer. Fiz., Vol. 36, No. 3, 956 (1959). In Russian.

It is shown that the theorem holds for waves of arbitrary intensity. P.Roman

530.12 : 530.145

NON-LOCAL INTERACTIONS AND THE SCATTERING MATRIX.
See Abstr. 9230

FIELD THEORY . QUANTUM THEORY

530.145

10569. INVESTIGATIONS ON QUANTUM THEORIES WITH INDEFINITE METRIC. A.Uhlmann.
Nuclear Phys., Vol. 12, No. 1, 103-16 (June(3), 1959). In German.

The conditions are examined under which a quantum theory with indefinite metric is equivalent to one with definite metric. The answer to this question depends on general properties of the physical states belonging to that theory. A physical state is called proper, if there exists at least one set of measurements the result of which individuates it completely; otherwise the physical state is called improper. It is necessary and sufficient for the existence of a physically equivalent quantum theory with definite metric, that there be proper physical states only. This result contains the theorem of Ascoli and Minardi (Abstr. 2104 of 1959). There is no form with definite metric of a quantum theory having some improper states among its physical states. In such a theory, one finds, besides an effect already described (Abstr. 7781 of 1959), that transition probability is not always symmetric.

530.145

10570. ON THE WAVE PROPAGATION IN THE NON-LINEAR FIELDS. T.Tanuti.
Progr. theor. Phys., Vol. 17, No. 3, 461-86 (March, 1957).

Wave propagation in two non-linear fields is studied, one of which is the Born-type field and the other relativistic hydrodynamics. The discussion is restricted to one-dimensional progagation; the formation of shock waves and the energy distribution are investigated with special attention on the basis of the method of characteristics.

530.145

10571. NOTE ON THE WEAK AFFINE CONSERVATION LAWS OF THE MULTIMOMENTS WITHIN THE FRAMEWORK OF A GENERALLY RELATIVISTIC COVARIANT LAGRANGE FORMALISM. G.Knapecz.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 5-6, 340-4 (1959). In German.

By a multimoment is understood any quantity which is given by a sum of products of coordinates and energy-like quantities. The case of strong conservation laws of a generally relativistic covariant wave-field has been investigated by Mizkjewitsch. The present paper extends this study to the case of weak affine conservation laws. T.R.Carson

530.145

10572. SOME PROBLEMS ON THE ROTATION GROUP AND THE QUANTUM TOP. G.Lochak.
Cahiers de Phys., Vol. 13, 41-80 (Feb., 1959). In French.

The properties of the rotation group are investigated and it is shown that the functions of half-integral order represent permissible states of the quantum top as well as those of integral order. Such states must exist in nature but would be very rare, and therefore unobservable, on account of the difficulty in exciting them. The situation is analogous to that obtaining with respect to the allotropic states of hydrogen and helium. It is tentatively suggested that the spins of elementary particles may be explained along similar lines. T.R.Carson

530.145

10573. THE UNCERTAINTY PRINCIPLE AND RUTHERFORD SCATTERING. D.V.Gogate.
Curr. Sci., Vol. 28, No. 2, 60 (Feb., 1959).

Rutherford scattering is used as an example of the Heisenberg Uncertainty Principle. It is shown that: $\Delta p . \Delta x \geq \lambda p/(\sin 2\theta)^2 \geq h$, where Δp = uncertainty in momentum p, Δx = uncertainty in position, λ = particle wavelength, and 2θ = scattering angle. A.E.I.Research Laboratory

530.145

10574. GEOMETRICAL GENERALIZATION OF γ_5-INVARIANCE. S.Watanabe.
Nuovo Cimento, Vol. 13, No. 1, 144-7 (July 1, 1959).

It is shown that all the free Lagrangians and the well-established strong, intermediate and weak interaction Lagrangians are invariant for a special transformation which has a simple geometrical meaning and is a natural generalization of the γ_5-transformation. This invariance with certain further requirements can limit the possible interaction types to a very small number.

530.145

10575. LINEAR VECTOR SPACES WITH INDEFINITE METRIC. L.K.Pandit.
Nuovo Cimento Suppl., Vol. 11, No. 2, 157-82 (1959).

This is a review of several papers dealing with an indefinite metric and its applications to the Klein–Gordon equation, quantum electrodynamics and the Lee model. W.A.Hepner

530.145

10576. ON PARITY CONSERVATION IN STRONG INTERACTIONS. N.Dallaporta.
Nuovo Cimento, Vol. 13, No. 1, 159-72 (July 1, 1959).

The analogy in respect to γ_5 invariance between the two-component Dirac equation for the neutrino and the Schremp–Gürsey type equation describing baryons is used in order to express the Lagrangian for strong interactions as the sum of two types of parity non-conserving terms formally similar to those adopted for weak interactions. These terms, however, when suitably grouped, may be shown to compensate each other in order that parity is always conserved and the conventional Lagrangian is obtained; the compensation is a consequence of the fact that the number and disposition of the baryon states in the elementary particle scheme is such as to allow this grouping of compensating pairs; the original asymmetry remains only detectable in the mass differences between baryons, which may naturally be thus interpreted as a consequence of it.

530.145

10577. THE VERIFICATION OF THE PARITY CONSERVATION FOR STRONG INTERACTIONS. V.G.Solov'ev.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 628-9 (1959). In Russian.

PC invariance and isotopic spin invariance are not sufficient to guarantee parity conservation in K–baryons interactions. For the process $\Pi \; N \rightarrow K + \gamma$ followed by $\gamma \rightarrow N + \Pi$, it is suggested

that the possible longitudinal polarization of the hyperon can depend on the direction in which the hyperon is produced. At higher pion energy, the reaction

$$\Pi^- + p \rightarrow \Sigma^- + K^+ + \Pi^0$$

is singled out. Since there should be some asymmetry in the distribution of the K relative to the plane of the in-going pion and outgoing hyperon. J.Lascoux

530.145

10578. AN ATTEMPT OF GENERALIZING THE HYPOTHESIS OF CHARGE INDEPENDENCE. I. SELECTION RULE FOR THE DECAY PROCESS. O.Hara and Y.Fujii.
Progr. theor. Phys., Vol. 17, No. 3, 313-25 (March, 1957).

An attempt is made to generalize the hypothesis of charge independence to weak interactions. The fundamental assumption is that the strangeness quantum number if not a scalar but the third component of an angular momentum vector in the charge space, and the sum of this new vector and the usual isotopic spin is conserved in all processes. The case when the usual charge independence holds is assumed to correspond to the special case when these two vectors are conserved separately. It is shown that this assumption leads, when combined with the composite hypothesis proposed by Markov and Sakata, to a consistent level scheme for hyperons and heavy mesons, and moreover gives a new selection rule for the decay process which is essentially equivalent to $|\Delta I| = \frac{1}{2}$ suggested by many authors. It gives also other results which can be compared with experiments directly. Among them a preliminary discussion is given on a new selection rule expected in the annihilation of nucleon–antinucleon pairs. A comment on the b-field proposed by Yang and Mills is also given.

530.145

10579. A POSSIBLE METHOD FOR THE DETERMINATION OF THE PARITY OF STRANGE PARTICLES. S.M.Bilen'kii.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 291-2 (1959). In Russian.

It is suggested that parity of the K-mesons can be determined by investigation of the left–right asymmetry in the $\pi(K) + p \rightarrow Y + K(\pi)$ reactions with a polarized proton target.

530.145

10580. THE LIMIT, AT THE VELOCITY OF LIGHT, OF A PARTICULAR SYSTEM OF EINSTEIN-KRAMERS PARAMETERS. P.Hillion.
C.R. Acad. Sci. (Paris), Vol. 248, No. 19, 2731-3 (May 11); No. 20, 2853-5 (May 20, 1959). In French.

The motion of a relativistic particle with spin has been described in terms of a set of Einstein–Kramers parameters which form a system of four orthonormal 4-vectors. This system is shown to degenerate into a system of three orthonormal 3-vectors in the limit as the velocity tends to that of light. It is noted that the limiting spin is parallel or antiparallel to the velocity. R.A.Newing

530.145

10581. AN EXAMPLE OF A FIELD THEORY WITH INDEFINITE METRIC IN HILBERT SPACE. II. A.A.Komar and M.A.Markov.
Nuclear Phys., Vol. 12, No. 2, 190-203 (July (1), 1959).

For Pt I, see Abstr. 6502 (1959). A Lagrangian formalism is set up for the field equations proposed previously. Energy-momentum tensors and current vectors are derived for boson and fermion fields and the corresponding conservation laws are considered. In space–time regions close to the light cone and hyperboloid, the energy density of the boson field and charge density of the fermion field are not positive definite. The integrals of these quantities over the whole volume (energy and charge) are definite. The appearance of negative densities is interpreted in accordance with the modification of the concept of a particle coordinate proposed in Pt I.

530.145

10582. THEORY OF THE NONLINEAR FIELD $(\Box - \lambda\varphi^2)\varphi = 0$. G.F.Kurdgelaidze.
Zh. eksper. teor. Fiz., Vol. 36, No. 842-9 (1959). In Russian.

A spectral expansion of the energy of the field is given based on the exact solution of the field equation. A mass spectrum of the type $\Gamma_0^{(n)} = (2n + 1)M\Gamma_0^{(0)}$, n = 0, 1, 2, . . . has been obtained. An exact radially-symmetric solution of the field equation has been derived. A general method for integrating the nonlinear Dirac equation is presented and it is shown that in some cases one can pass to a two-component spinor equation of the second order.

530.145

10583. A CERTAIN VARIANT OF NONLOCAL ELECTROMAGNETIC FIELD THEORY. A.A.Komar and M.A.Markov.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 854-8 (1959). In Russian.

A nonlocal theory is considered which corresponds to a modification of the Lienard–Wiechert potential. It is demonstrated that if an equation of the usual type is assumed to hold for the potential given by

$$\Box A_\mu = -\frac{4\pi}{c} j_\mu ,$$

one finds in a consistent relativistic treatment (many-time) formalism) that contradictions appear within the framework of the classical theory.

530.145

10584. FIELD THEORY MODEL WITH A NON-VANISHING RENORMALIZED CHARGE. A.A.Ansel'm.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 863-8 (1959). In Russian.

Two fermion fields are considered in a unidimensional space (and time), each of these fields interacting with each other and with themselves. The first term in the expansion of the vertex part in an asymptotic series is obtained. It is shown that, under certain conditions, the renormalized charge may possess an arbitrary (nonvanishing) value.

530.145

10585. GENERAL INTEGRAL FORMULA OF PERTURBATION TERM IN THE QUANTIZED FIELD THEORY. N.Nakanishi.
Progr. theor. Phys., Vol. 17, No. 3, 401-18 (March, 1957).

An arbitrary perturbation term in quantized field theory is expressed explicitly in terms of a generalized Feynman parametric integral, after all integrations of momenta are carried out. By means of this general integral formula Dyson's power-counting theorem as well as the absence of odd order divergences are proved rigorously, and Lehmann's spectral function $\rho(u)$ is given explicitly in perturbation expansion. Some remarks are made on the convergence of perturbation series.

530.145

10586. ON THE QUANTIZATION OF THE DIRAC FIELD. W.Franz.
Z. Naturforsch., Vol. 14a, No. 5-6, 493-9 (May-June, 1959). In German.

The development of a new scheme of field quantization is claimed, which is supposed to take into account from the outset the fact that the state function is an expression of the knowledge of the observer about the system. The observer is incorporated into the physical system. The boundary conditions of the employed variational principle allow only for an expanding universe. P.Roman

530.145

10587. Q-NUMBER MODIFICATION OF THE LORENTZ ROTATIONS. V.Rojansky.
Phys. Rev., Vol. 114, No. 2, 634-5 (April 15, 1959).

The term $\rho_3 mc^2$ in the Dirac equation is replaced by $(\rho_3 a + \pi_3\rho_3 b_1 + \pi_1 b_2)mc^2$, where a, b_1, and b_2 are non-vanishing constants, and the π's are anticommuting square roots of unity that commute with the ρ's and the σ's. The resulting irreducible eight-component wave-equation is not invariant under Lorentz rotations but is invariant under similar transformations, in which the angle is multiplied by π_3. The question is raised whether such rotations through hyperbolic q angles may not be the proper quantum modification of the classical Lorentz rotations.

530.145

10588. CALCULATION OF EFFECTS OF THE ADDITIONAL TERM OF FEYNMAN AND GELL-MANN IN β-DECAY. M.Lacombe.
C.R. Acad. Sci. (Paris), Vol. 249, No. 1, 74-6 (July 6, 1959). In French.

Some consequences of the Feynman–Gell-Mann theory (Abstr. 507 of 1958) are studied. The effects are too small to provide an experimental test of the theory, however. R.J.N.Phillips

530.145

10589. PAIR-CREATION OF FERMIONS WITH SPIN 3/2 DUE TO THE MOTION OF A BOSON IN AN EXTERNAL FIELD. I. B.N.Rolov.
Latv. PSR Zinat. Akad. Vestis, No. 1 (138), 97-101 (1959). In Russian.

The cross-section for the pair-production of spin $\frac{3}{2}$ fermions in

an external field is calculated, to the lowest order of approximation, using standard techniques, assuming that the boson is a pseudoscalar meson and has a pseudoscalar coupling. P.Roman

530.145

10590. PAIR-CREATION OF FERMIONS WITH SPIN 3/2 DUE TO THE MOTION OF A BOSON IN AN EXTERNAL FIELD. II.
B.N.Rolov.
Latv. PSR Zinat. Akad. Vestis, No. 3 (140), 45-8 (1959).
In Russian.

The cross-section of Pt I (preceding abstract) is calculated, but assuming a pseudovector coupling. In this case the ratio of spin $\frac{3}{2}$ to spin $\frac{1}{2}$ pair-creation is practically independent of the meson energy. P.Roman

530.145

10591. TWO-PHOTON ANNIHILATION OF FERMION-PAIRS WITH SPIN 3/2. B.N.Rolov.
Latv. PSR Zinat. Akad. Vestis, No. 4(141), 43-8 (1959). In Russian.

Using Gupta's formalism, the annihilation cross-section is calculated in the lowest order of perturbation. P.Roman

530.145

10592. PION–BARYON INTERACTIONS AND "CLOSED LOOP" PHENOMENA. A.N.Mitra.
Nuclear Phys., Vol. 12, No. 2, 133-8 (July (1), 1959).

The effect of strong pion–hyperon interactions on $\pi^0 \rightarrow 2\gamma$ decay and $\pi-\pi$ interaction, both of which are "closed loop" processes, is examined. It is found that while the interaction of pions with hyperons helps to reduce the decay rate of π^0, it leads to an unreasonably strong $\pi-\pi$ attraction. To reduce the attraction it is suggested that either the meson–meson divergence should not be renormalized or π–K interactions of the Yukawa type should be invoked.

530.145

10593. ON A SYMMETRY IN WEAK INTERACTIONS.
A.Gamba, R.E.Marshak and S.Okubo.
Proc. Nat. Acad. Sci. U.S.A., Vol. 45, No. 6, 881-5 (June, 1959).

Suggests that the weak interactions might be invariant under the simultaneous interchanges $\Lambda \rightarrow \mu$, $n \rightarrow e$, $p \rightarrow \nu$. A number of consequences of this hypothesis are given, and those that can be tested are consistent with experiment. J.C.Taylor

530.145

10594. ASYMPTOTIC THEORY OF ONE-DIMENSIONAL FOUR-FERMION INTERACTION. A.A.Ansel'm.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1522-31 (1958). In Russian.

A fermion field which interacts with itself is examined for the case when a single space and a single time coordinate are involved. Asymptotic expressions for the vertex part and the Green's function are obtained by summation of a infinite number of graphs. It is shown that the theory is practically devoid of divergences and that renormalization of the charge is absent. It is found that whereas the one-limit procedure leads to a correct expression for the first term in the expansion of the exact solution in an asymptotic series, the two-limit procedure yields an incorrect result. The theory is compared with the exact solution obtained by Thirring, (Abstr. 2758 of 1958).

530.145

10595. RELATIVISTIC CORRECTIONS TO PHENOMENOLOGICAL HAMILTONIANS. Yu.M.Shirokov.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 474-7 (1959). In Russian.

A general expression has been obtained for the relativistic corrections of the order of $(v/c)^2$ to a phenomenologically-described non-relativistic Hamiltonian for the interaction between particles of arbitrary mass and spin.

530.145

10596. γ_5-INVARIANCE AND STRONG INTERACTIONS.
B.Stech and G.Kramer.
Z. Phys., Vol. 154, No. 1, 128-32 (1959). In German.

In Abstr. 2597 (1959), a generalized γ_5-invariance for strong interactions was proposed and some consequences of this invariance were outlined. The present paper contains the detailed proof and discussion of these consequences. For the baryon–pion interactions one obtains two possible forms for the coupling. (a) The coupling is determined by the total I-spin vector current and contains no direct $\Lambda\Sigma\pi$-coupling. This interaction turns out to be strictly parity conserving even in the presence of electromagnetic and I-spin invariant K-meson couplings. (b) The baryon–pion interaction has global symmetry and thus contains a direct $\Lambda\Sigma\pi$-coupling. In this case the baryon–pion interactions are strictly parity conserving only as long as one can neglect unsymmetric K-meson couplings. The K-meson couplings themselves should violate the invariance against space reflections.

530.145 : 539.12

DECAY OF THE CASCADE PARTICLES. See Abstr. 9964

530.145 : 539.12

ASSOCIATED PRODUCTION BY NON-LOCAL INTERACTION. See Abstr. 9994

530.145

10597. METHOD FOR CALCULATING CORRELATIONS IN SYSTEMS OF MANY PARTICLES. Chen' Chun'-Syan'.
Dokl. Akad. Nauk SSSR, Vol. 125, No. 6, 1238-41 (April 21, 1959).
In Russian.

A general scheme is proposed for the calculation of correlations from the integral equation satisfied by the many-particle Green's function, and a method suggested for its approximate solution. P.K.Kabir

530.145

10598. THE INFLUENCE OF CONSTANT ELECTRIC AND MAGNETIC FIELDS ON THE SPIN OF THE PARTICLE. S.Sarkar.
Indian J. Phys., Vol. 32, No. 3, 124-7 (March, 1958).

If one assumes that the particle obeys the second order equation obtained in the usual way of operating twice the Dirac's linear Hamiltonian, one finds that the change of momentum and spin direction of a particle subjected to magnetic and electric fields is the same as for a particle obeying Dirac's first-order equation.

530.145 : 538

10599. ON THE OBSERVATION OF MAGNETIC POLES. E.Goto.
J. Phys. Soc. Japan, Vol. 13, No. 12, 1413-18 (Dec., 1958).

Expected behaviour of magnetic poles, especially their interaction with magnetic matter is considered. The magnetic pole is supposed to be an elementary particle having magnetic true charge satisfying Dirac's quantum condition, namely 68.5 times as large as the electron charge. Magnetic poles would be attracted and trapped in ferromagnetic and paramagnetic matter. The magnetic minerals are the most promising source of magnetic poles and an efficient method for detecting the presence of even one magnetic pole among thousands of tons of magnetic minerals is proposed. This method is sensitive enough to detect such a small amount of magnetic pole as has escaped notice in all cosmic-ray observations so far conducted.

530.145

10600. IRREDUCIBILITY CONSTRAINTS AND FIELD EQUATIONS FOR THE ELEMENTARY PARTICLES. II. FERMIONS.
G.C.Bollini.
Nuovo Cimento, Vol. 13, No. 1, 46-56 (July 1, 1959).

For Pt I see Abstr. 5365 of 1959. The conditions needed to describe an elementary particle by an irreducible quantity in the Lorentz group, are here taken as constraint equations to be imposed on the field entity. The independent components are extracted in a covariant way. The field equations are deduced from a Lagrangian in which only the free components are permitted to be varied. The communication relations, compatible with the constraints, are also given. In Pt I the field entity was a tensor. In the present paper spin-tensors and simple Dirac spinors are considered for which second order equations are proposed. In a general summary a brief and unifying treatment is given for elementary particles of any spin

530.145

10601. ON THE DESCRIPTION OF UNSTABLE PARTICLES IN QUANTUM FIELD THEORY. M.Lévy.
Nuovo Cimento, Vol. 13, No. 1, 115-43 (July 1, 1959).

The mass and life-time of an unstable particle may be defined by the real and imaginary parts of a complex pole appearing on the Riemann surface in which its propagator can be continued analytically. This method, which was originally proposed by Peierls, is studied in detail, first on the basis of a special model, then in a more general field theory. The possibility of analytical continuation of the propagator is discussed, using the conditions of causality and unitarity of the S-matrix. The appearance of "unphysical" poles in the various sheets of the Riemann surface is also discussed. It is inferred that a physical principle must be used in each case, in order to select the particular pole which can be correctly interpreted as describing the properties of an unstable particle.

530.145 : 539.12

10602. QUANTUM FIELD THEORY OF UNSTABLE PARTICLES. H.Araki, Y.Munakata, M.Kawaguchi and T.Gotô.
Progr. theor. Phys., Vol. 17, No. 3, 419-42 (March, 1957).

Two methods of the renormalization are proposed for unstable particles. One is connected with resonance in scattering and the other with the time development of the unstable particle state. The relation between the two formulations is discussed. Arbitrariness in the choice of the renormalization procedure comes from the uncertainty principle of the quantum mechanics.

530.145

10603. A SPINOR MODEL IN THE QUANTUM THEORY OF NON-LINEAR WAVE-EQUATIONS. K.Ladányi.
Z. Naturforsch., Vol. 14a, No. 5-6, 580-1 (May-June, 1959). In German.

A new model in the theory of elementary particles is proposed and studied qualitatively. The Lagrangian is of the form

$$L = \psi_i^+ \gamma_\mu \partial_\mu \psi_i + \lambda_{ijkl} (\psi_l^+ \gamma_\mu a \psi_j)(\psi_k^+ \gamma_\mu \bar{a} \psi_l)$$

By a suitable choice of a and the λ-coefficients, many desirable features such as gauge- and iso-invariance, baryon conservation and charge independence can be represented. T.R.Carson

530.145 : 539.12

COMPOSITE BARYON MODEL. See Abstr. 9944

530.145 : 539.12

ON A SYSTEMATIC CLASSIFICATION OF MESONS AND BARYONS. See Abstr. 9963

530.145

10604. A REMARK ON HEISENBERG'S PAPER ON LEE'S MODEL. L.A.Maksimov.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 140-4 (1959). In Russian.

Two real discrete states of a V-particle in Lee's model are considered. It is shown that Heisenberg's method (Abstr. 4734 of 1958) can be extended to this case.

530.145

10605. ON THE ADIABATIC HYPOTHESIS.
L.M.Garrido Arilla and A.Galindo Tixaire.
An. Real Soc. Espan. Fis. Quim., Vol. 55 (A), No. 3-4, 127-32 (March-April, 1959). In Spanish.

Proof of the converse of Jauch's theorem (Abstr. 8400 of 1957): if, in a scattering problem, the final state has zero components over all bound states of the total Hamiltonian, this final state behaves asymptotically as a simple outgoing wave. L.Pincherle

530.145

10606. QUANTUM EFFECTS NEAR A BARRIER MAXIMUM.
K.W.Ford, D.L.Hill, M.Wakano and J.A.Wheeler.
Ann. Phys. (New York), Vol. 7, No. 3, 239-58 (July, 1959).

A potential barrier is considered which is parabolic over an appreciable region near its maximum. When the motion is unbounded to both left and right, the barrier penetrability is the quantity of interest. It does not follow the Gamow value near the summit, but instead shows a transition behaviour previously derived and here related to other phenomena. When the motion is symmetrically bounded on both left and right, energy levels below the barrier maximum are known to be associated in pairs of even and odd states, and are generally tacitly assumed to be unpaired above the barrier. The present analysis leads to a transition formula which shows that the pairing effect never vanishes but falls off smoothly with increase of the energy across the barrier maximum. When the motion is bounded to the left of the barrier and unbounded on the right, the quantity of interest is the phase shift. A "mixing formula" is derived which combines the semiclassical JWKB phase integrals to the left and right of the barrier to give a phase shift that varies smoothly through the barrier. In the analysis appears the function $\Gamma(\frac{1}{2} + i\epsilon)$, for which a simple optional approximation formula is presented. Typical curves are presented for the phase shift as a function of energy in the transition region.

530.145

10607. SEMICLASSICAL DESCRIPTION OF SCATTERING.
K.W.Ford and J.A.Wheeler.
Ann. Phys. (New York), Vol. 7, No. 3, 259-86 (July, 1959).

The quantum-mechanical scattering amplitude can be simply related to the classical deflection function when the conditions for a semiclassical analysis of the quantum-mechanical scattering are met. Various interesting characteristic features of the scattering are related to special features of the classical deflection function. The characteristic types of scattering discussed are: interference, when the deflection function possesses more than one branch at a given angle; rainbow scattering, when the deflection function has a relative maximum or minimum; glory scattering, when the deflection function passes smoothly through 0^0 or through an integral multiple of $\pm\pi$; and orbiting, when the deflection function possesses a singularity. The consideration of the characteristic features of semiclassical scattering makes possible the analysis of an observed differential cross section to yield the classical deflection function, which in turn may be used to construct the potential.

530.145

10608. APPLICATION OF SEMICLASSICAL SCATTERING ANALYSIS. K.W.Ford and J.A.Wheeler.
Ann. Phys. (New York), Vol. 7, No. 3, 287-322 (July, 1959).

Several different examples of scattering processes are analysed, and for each, semiclassical approximations are discussed. The scattering of magnetic monopoles by charged particles is an illustrative example demonstrating rainbow and glory effects. In this example, exact classical and quantum results are also obtained and comparison made with semiclassical results. For the scattering of alpha particles by nuclei, the influence of absorption and of the phenomenon of orbiting on the cross-section are studied semiclassically, and comparison with experiment is made. For the scattering of atoms by atoms, rainbow, glory, and orbiting effects may all exist, and one example is worked out semiclassically in detail. The scattering of electrons or muons by nuclei is discussed briefly and the semiclassical analysis shown not to be valid at any energy.

530.145

10609. ON ISOBARS OF THE NUCLEON CAUSED BY THE KAON [K-MESON] FIELD IN A FIXED-SOURCE THEORY. W.Królikowski.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 7, No. 4, 245-50 (1959).

530.145

10610. ON THE DIFFERENTIAL EQUATIONS OF THE MOTION OF A MESONIC CHARGE. I.S.Arzhanykh.
Dokl. Akad. Nauk SSSR, Vol 125, No. 6, 1215-18 (April 21, 1959). In Russian.

530.145

10611. AN EXAMPLE ON THE NUCLEON VERTEX. R.Jost.
Helv. phys. Acta, Vol. 31, No. 3, 263-72 (1958). In German.

It is shown by means of an example that the localized exchange relations and the mass-spectrum alone are insufficient to derive the dispersion relations for the nucleon vertex.

S.J.St-Lorant

530.145

10612. ON THE UNPHYSICAL REGION IN DISPERSION RELATIONS.
R.F.Streater.
Nuovo Cimento, Vol. 13, No. 1, 57-76 (July 1, 1959).

Conditions on the masses of four particles are written down such that present methods can prove inelastic dispersion relations for processes of the type $A + B \to C + D$. One necessary condition is that both elastic relations $A + B \to A' + B'$ and $C + D \to C' + D'$ can be proved for forward scattering at least. The masses of $p\,n\,\pi^-\,\pi^0$ satisfy the conditions, and also photomeson production, and the model K-meson system $K = 3\Pi/2$, $\Lambda \cong N$ (where these are the masses of the particles). Using dispersion relations and the unitarity condition for the unphysical region of this model system, integral equations for the unphysical region in $KN \to \Lambda\pi$ relations are obtained; these equations have solutions in terms of physical S-matrix elements. It is also possible to set up a model $KN \to KN$ system such that the usual dispersion relations can be proved by present methods, and also all the inelastic relations which the method of this paper needs in order to interpret the unphysical region. However, a model can be constructed suth that dispersion relations can be proved, but such that their unphysical region cannot be interpreted by present methods.

530.145

10613. POTENTIALS WITH ZERO SCATTERING PHASE.
H.E.Moses and S.F.Tuan.
Nuovo Cimento, Vol. 13, No. 1, 197-206 (July 1, 1959).

Consider the class of spherically symmetrically symmetric potentials which are so smooth that the functions f(k) are analytic in the lower half plane. The Gel'fand—Levitan equation is used to construct all potentials of this class which, for a given angular momentum, have scattering phases which are identically zero for all energy. In these cases the potentials support point eigenvalues

which are either zero or are positive and embedded in the continuous spectrum. In the case $l = 0$, the potential which supports the zero point eigenvalue was given earlier by Bargmann who used a special technique to find it.

530.145

10614. APPROXIMATE SOLUTIONS OF THE DENSITY MATRIX EQUATION FOR A LOCAL AVERAGE FIELD.
N.H.March and W.H.Young.
Nuclear Phys., Vol. 12, No. 3, 237-40 (July 2, 1959).

It is shown that a condition derived by Naqvi (Abstr. 8495 of 1959) from the density matrix equation and used to generalize the statistical theory, can be regarded as constituting a differential form of the virial theorem. This suggests that Naqvi's condition is satisfied by the customary treatments, and this is demonstrated directly.

530.145

10615. LOW'S SCATTERING EQUATION AND S-MATRIX.
H.Fukutome.
Progr. theor. Phys., Vol. 17, No. 3, 383-400 (March, 1957).

Without reference to the details of the interaction, Low's scattering theory is formulated including scatterings of bound particles. The Low equation is derived in two forms: the differential form in the Heisenberg representation, and the form similar to the second-order perturbation formula in the Schrödinger representation. Corresponding to which state is used as the comparison state, there exist various types of the Low equation and expressions of the S-matrix. From these Low equations the symmetry properties of the S-matrix are deduced. Using the differential form of the Low equation, it is shown that the Low equation in which the comparison state is the vacuum can be linearized, and has infinitely many solutions as has been pointed out by Castillejo et al.

530.145 : 539.12

10616. LOW-ENERGY APPLICATION OF RELATIVISTIC K-MESON—NUCLEON DISPERSION RELATIONS. P.K.Roy.
Phys. Rev. Letters, Vol. 2, No. 8, 364-5 (April 15, 1959).

Examines whether the dispersion equations are consistent with any P-state resonance. Concludes that no K—N resonance is to be expected, but $\bar{K}$—N resonances may occur. R.J.N.Phillips

530.145

10617. SPIN STRUCTURE OF THE SCATTERING MATRIX FOR REACTIONS INVOLVING γ-QUANTA. V.I.Ritus.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1485-7 (1958). In Russian.

A representation of the scattering matrix for reactions involving γ-quanta (of the type $\gamma + b \to a' + b'$ and $\gamma + b \to \gamma' + b'$) is examined in the form of an expansion in spin operators Q_i, which are invariant under rotations. A method of setting up the independent operators Q_i is proposed and their number is determined. The restrictions which the condition of invariance under time reversal imposes on the form and number of operators Q_i are considered. Some examples are given of representation of the S matrix in terms of operators Q_i for reactions in which the spin of particle b and system $a' + b'$ ($\gamma + b' \to a' + b'$) and the spin of particles b,b' ($\gamma + b \to \gamma' + b'$) do not exceed unity.

530.145

10618. TWO-NUCLEON LS-POTENTIAL IN NON-RELATIVISTIC MESON THEORY. Yu.V.Novozhilov and I.A.Terent'ev.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 129-39 (1959). In Russian.

The potential between nucleons is calculated in a linear manner, with respect to the velocity approximation (recoil being partly accounted for), without the aid of perturbation theory. A potential is found which decreases as $\exp(-2R)$ and depends on the coupling constant as well as on the π—N scattering cross-section.

530.145

10619. ELASTIC SCATTERING OF POLARIZED DIRAC PARTICLES BY A SHORT-RANGED CENTRAL FORCE, BY THE THEORY OF PHASES. I.I.Guseinov.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 331-3 (1959). In Russian.

The differential cross-section, which includes a factor giving azimuthal asymmetry not present in the case of unpolarized particles, is given in terms of the proper phase-shifts. [This is a rather well-known result and is given, for example, by Lepore (Abstr. 8242 of 1950)]. P.K.Kabir

530.14

10620. THE SHAPIRO INTEGRAL TRANSFORMATION.
Chzhou Guan-Chzhao and L.G.Zastavenko.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1417-25 (1958).
In Russian.

An integral transformation is presented which is related to an expansion of the representation by which the wave-function of a particle of mass M and spin s transforms into irreducible representations of the proper Lorentz group.

STATISTICAL MECHANICS

TRANSFER PROCESSES

530.162 : 538.1

10621. RETARDED AND ACCELERATED GREEN FUNCTIONS IN STATISTICAL PHYSICS. N.N.Bogolyubov and S.V.Tyablikov.
Dokl. Akad. Nauk SSSR, Vol. 126, No. 1, 53-6 (May 1, 1959).
In Russian.

The authors obtain spectral representation of these functions, following the work of Lehmann (Abstr. 5288 of 1954) and of Callen [Helv. Phys. Acta, Vol. 25, 417 (1952)]. As a particular example, they consider the Heisenberg model of a ferromagnetic body.
J.K.Skwirzynski

530.162

10622. NOTE ON A PERTURBATION CALCULATION IN STATISTICAL MECHANICS. J.Yvon.
Nuovo Cimento Suppl., Vol. 9, No. 1, 144-51 (1958). In French.

This paper treats a classical fluid of identical interacting particles in an applied potential. Two integral equations are derived for the change in density caused by a small change in the applied potential; one involves the pair distribution function n_{12} and the other a function H_{12} defined by an expansion in powers of the density whose first term is $n_1 n_2[\exp(-W_{12}/kT) - 1]$. An algebraic relation connecting the Fourier transforms of n_{12} and H_{12} is deduced for the spatially uniform case. This relation is used to discuss the critical point and to estimate the asymptotic behaviour of n_{12} for large particle separations. O.Penrose

530.162

10623. STATIONARY NONEQUILIBRIUM GIBBSIAN ENSEMBLES.
J.L.Lebowitz.
Phys. Rev., Vol. 114, No. 5, 1192-202 (June 1, 1959).

The general theory of a Gibbs ensemble representing a system in contact with its surroundings is applied to several concrete situations of interest. By an appropriate choice of heat reservoirs a simply modified Liouville equation is found to describe a heat conducting system. The stationary nonequilibrium Γ-space ensembles which describe such a system are found explicitly for some cases. In the simplest cases these ensembles turn out to be canonical with a temperature that is a weighted average of the reservoir temperatures. For other systems, such as Brownian particles inside a fluid whose temperature is not uniform, the stationary ensemble is found to terms linear in the temperature gradient. This leads to a discussion of ensembles that will approximately represent an arbitrary heat conducting fluid. A more general proof than previously given for the asymptotic approach of the Γ-space distribution to its stationary value is also presented.

530.162

10624. STATISTICAL MECHANICS OF RIGID SPHERES.
H.Reiss, H.L.Frisch and J.L.Lebowitz.
J. chem. Phys., Vol. 31, No. 2, 369-80 (Aug., 1959).

An equilibrium theory of rigid sphere fluids is developed based on the properties of a new distribution function G(r) which measures the density of rigid sphere molecules in contact with a rigid sphere solute of arbitrary size. A number of exact relations which describe rather fully the functional form of G(r) are derived. These are based on both geometrical considerations and the virial theorem. A knowledge of G(a) where a is the diameter of a rigid sphere enables one to arrive at the equation of state. The resulting analytical expression which is exact up to the third virial coefficien gives the fourth virial coefficient within 3% and the fifth, insofar as it is known, within 5%. Furthermore over the entire range of fluid density, the equation of state derived from theory agrees with that computed using machine methods. Theory also gives an expression for the surface tension of a hard sphere fluid in contact with a perfectly repelling wall. The dependence of surface tension on curvature is also given. The expressions obtained correlate nicely

with those adduced by other thermodynamic and statistical mechanical theories. They also suggest that macroscopic consideration on surface tension can sometimes be successfully extrapolated to molecular dimensions.

530.162 : 532.7

10625. MOLECULAR DYNAMICS COMPUTATIONS FOR THE HARD SPHERE SYSTEM. T.Wainwright and B.J.Alder.
Nuovo Cimento Suppl., Vol. 9, No. 1, 116-32 (1958).

Typical motions of N hard spheres in a periodic box have been computed electronically for various densities and values of N ($32 \leq N \leq 500$). Statistical calculations were made from these. Starting from a non-Maxwellian distribution, Boltzmann's H invariably decreased monotonically, reaching equilibrium after about two collisions per particle. The velocity autocorrelation function had the form $e^{-\alpha t}$ for densities below about $\frac{1}{2}$ (close-packed density ≡ 1) but took negative values at higher densities, e.g. 1/1.6. The diffusion coefficient, calculated from the autocorrelation function, agreed well with Enskog's theory [Hirschfelder, Curtiss, and Bird, Molecular Theory of Gases and Liquids. New York (1954)] whenever the autocorrelation function was $e^{-\alpha t}$. The average momentum transfer per collision agreed with Enskog's theory at all densities. The pressure was calculated using the virial theorem from the average rate of transfer of momentum at collisions. For densities between 1/1.7 and 1/1.5 the systems tended to make spontaneous transitions between two states of different pressure; with the help of photographs of trajectories the low-pressure state is interpreted as a solid phase and the high-pressure state as a fluid phase. Radial distribution functions have also been studied, but few details are given here. O.Penrose

530.162 : 536.71

10626. RECENT MONTE CARLO CALCULATIONS OF THE EQUATION OF STATE OF LENNARD-JONES AND HARD SPHERE MOLECULES. W.W.Wood, F.R.Parker and J.D.Jacobson.
Nuovo Cimento Suppl., Vol. 9, No. 1, 133-43 (1958).

Calculations are performed of a pressure—volume isotherm and of the radial distribution function. This paper is mainly concerned with comparing results obtained with results of alternative calculations and of experiment. Calculations with the rigid sphere model of molecules indicate that there is a transition point at a density of approximately 2/3 of the closed packing density.
R.Eisenschitz

530.162 : 536.71

10627. THE EQUATION OF STATE OF AN IMPERFECT GAS OF ELASTIC SPHERES. H.N.V.Temperley.
Nuovo Cimento Suppl., Vol. 9, No. 1, 163-5 (1958).

The author discusses a model for molecules with repulsive interaction which has the merit of greatly simplifying the deduction of the partition function. Taking account of certain results of the theory of restricted random walk he outlines an approach to the calculation of the virial coefficients. R.Eisenschitz

530.162

10628. EVALUATION OF THE TWO-PARTICLE DISTRIBUTION FUNCTION OF AN IMPERFECT QUANTUM GAS. GENERAL METHOD. L.Colin and J.Peretti.
C.R. Acad. Sci. (Paris), Vol. 248, No. 11, 1625-8 (March 16, 1959). In French.

A method is given whereby the two-particle distribution function can be expressed in terms of the temperature and the fugacity.
P.T.Landsberg

530.162

10629. CONDENSATION OF AN IMPERFECT BOSON GAS. R.H.Kriachnan.
Phys. of Fluids, Vol. 2, No. 4, 463-5 (July-Aug., 1959).

The nature of the Einstein—Bose condensation in an imperfect boson gas is discussed. It is argued that no matter how low the temperature, provided it is not zero, macroscopic second-sound waves should be weakly excited as thermal fluctuations about equilibrium. This implies that the single-particle momentum distribution must be smeared so that the state of zero momentum cannot contain a finite fraction of the particles. A microscopic mechanism which independently leads to a momentum spread is discussed. It is suggested that the actual Einstein—Bose condensation of an imperfect gas takes places in energy rather than momentum but that even in terms of this variable it becomes perfectly sharp only at zero temperature. This hypothesis is formulated analytically in terms of correlation functions of the second-quantized boson field.

530.162

10630. RELAXATION PROCESSES IN MULTISTATE SYSTEMS. K.E.Shuler.
Phys. of Fluids, Vol. 2, No. 4, 442-8 (July-Aug., 1959).

An analysis is made of the relaxation of "multistate" systems, i.e., systems with more than two quantum states or two different chemical species, for linearized processes described by the "Master Equation" of the theory of transport processes. These results are compared with those obtained from the analysis of two-state relaxation processes and the concept of "relaxation time" is discussed in this framework. A discussion is presented of the transformation of microscopic to macroscopic relaxation equations. The existence of periodic and/or aperiodic oscillatory solution of the linear multistate relaxation equation is investigated. It is shown that the multistate relaxation equations admit of aperiodic oscillatory solutions.

530.162

10631. MOLECULAR RELAXATION IN μ-AND Γ-SPACE. E.I.Takizawa and J.Meixner.
Z. Naturforsch., Vol. 14a, No. 4, 418-24 (April, 1959). In German.

By molecular relaxation is understood the attainment of a Boltzmann distribution among the occupation numbers of the molecular states. The transitions between the states of a single molecule is described as a Markoff process represented by the Fokker—Planck equation in μ-space, while the behaviour of the whole gas is described by the Fokker—Planck equation in Γ-space. T.R.Carson

530.162

10632. THE MACROSCOPIC EQUATIONS FOR SIMULTANEOUS HEAT AND MASS TRANSFER IN ISOTROPIC, CONTINUOUS AND CLOSED SYSTEMS. H.J.Merk.
Appl. sci. Res. A, Vol. 8, No. 1, 73-99 (1958).

In the literature concerning the phenomenological theory of heat and mass transfer in multicomponent systems various formulations of the macroscopic equations are found. In order to decide which formulations are correct, a more or less complete survey of the macroscopic equations is given. Since no disagreements exist concerning the ultimate formulation of the equation of motion, special attention is given to the diffusion equations and the thermal energy equation. The ultimate formulation of the latter equation given in the present paper differs in some details from that found in the literature, the difference being caused by the effect of the diffusing heat capacities and by the dependence of the enthalpy on the concentration. In order to find a proper driving force for the mass transfer, use is made of formulae taken from the thermodynamics of irreversible processes. It appears that for binary systems the barycentric description of the diffusion is the most suitable, especially when convection phenomena play an important role. For multicomponent systems it seems better to relate the diffusion fluxes to the activity. In this case Maxwell's diffusion laws are easily obtained, showing that relations, hitherto only derived in a first approximation for ideal gases, are generally valid for ideal as well as non-ideal systems. From the exact relations simplfied descriptions of the diffusion may be derived. If it is, for instance, assumed that Maxwell's diffusion coefficients are all equal and that the system is ideal, then diffusion equations can be derived which are analogous to those for binary systems. In addition, a simplfied version of the thermal energy equation is indicated, which differs somewhat from that given by Spalding and Emmons.

530.162 : 539.19

CALCULATION METHOD FOR THE DYNAMICS OF MANY-PARTICLE SYSTEMS. See Abstr. 10207

530.162

10633. ON THE THEORY OF THE BROWNIAN MOTION. M.Toda.
J. Phys. Soc. Japan, Vol. 13, No. 11, 1266-80 (Nov., 1958).

The Brownian motion of an oscillator in a thermostat is considered, assuming simple forms of interaction between them. No further assumption is made, except that the thermostat is always in thermal equilibrium with itself. Solving the Liouville equation (or its counterpart in quantum mechanics) the long time evolution of the system is clarified. Thus the theory connects automatically the irreversible and the equilibrium behaviours of the system without any ad hoc assumption. The results include, as a special case, the equation derived by Kramers and Chandrasekhar, using the theory of stochastic processes. It is shown that the oscillating part of the distribution function or the density matrix plays an important role to which the peculiar way of damping of the oscillator is to be attributed.

530.162 : 621.396.822 : 621.38

10634. RANDOM NOISE. [Le bruit de fond].
P.Grivet and A.Blaquière.
Paris: Masson et Cie (1958) x+ 495 pp. [Cours d'Electronique. IV].
In French.

Comprehensive introduction to the theoretical and practical aspects of random noise. An introductory chapter summarizes the experimental aspects of noise phenomena and the fundamental laws which noise obeys. The relation between the law of equipartition of energy and the theory of noise in resistors, is discussed by methods based on Einstein's treatment of the Brownian movement and on the application of kinetic theory to an electron gas in equilibrium with ions or molecules in a metal. Shot noise in thermionic valves is treated for both temperature limited and space charge limited regimes and the influence of transit time is considered in the high frequency case. Partition noise and flicker effect are also discussed. The theory of transmission of noise by linear networks containing both active and passive elements is considered, and practical methods for the measurement of noise factor are discussed. Further chapters deal with noise in photo-multipliers, low noise input stages for wide-band amplifiers, the effects of positive and negative feedback, and also with some non-linear problems including those of noise in detectors and self-oscillators. Noise in transistors and crystal diodes is treated in mainly qualitative terms. After discussing the statistical properties of noise and its mathematical representation, a concluding chapter reviews the fundamentals of information theory including the problem of noise reduction by the choice of a suitable code. Each chapter ends with an extensive bibliography and is adequately illustrated. G.D.Sims

530.162 : 537.311.33

10635. SOME STATISTICAL PROBLEMS IN SEMICONDUCTORS.
P.T.Landsberg.
Semiconductors and phosphors. See Abstr. 9597. pp. 45-62.

A theoretical paper devoted to statistical mechanical problems in semiconductors, from the approach of the grand canonical assembly. It amends current semiconductor theory to allow for the phenomenon of multiple trapping levels at defects, which affects the basic equation of semiconductor statistics, that determining the Fermi level. In the first part of the paper, which is devoted to trapping statistics, semiconductor statistics are generalized, the mass action law is considered, and certain special cases are dealt with. The analogy with adsorption isotherms is described. The second part considers other statistical problems: the significance of temperature-dependent energy levels, the Meyer—Nedel rule and its relation to the theories of Busch, Mitchell and Gisolf, and the self-consistency of Hall effect and conductivity measurements. There are 5 appendices, dealing with various aspects of the theory. J.B.Birks

530.162 : 621.396.812.3

10636. ON THE THEORY OF FADING PROPERTIES OF A FLUCTUATING SIGNAL IMPOSED ON A CONSTANT SIGNAL.
H.Bremmer.
Circ. Nat. Bur. Stand., No. 599, 32 pp. (1959).

A theoretical investigation of the fading properties of a signal composed of a fluctuating contribution, and another steady contribution with fixed amplitude and phase. It is assumed that the central-limit theorem may be applied to two proper quantities describing the fading signal as a quasi-monochromatic function of the time. The results are applicable to any autocorrelation function for the fluctuating contribution. The first part of the paper is mainly restricted to the idealized case in which any two components of the fluctuating part of the complete signal that are in quadrature with respect to their phase do have identical statistical properties; the fluctuating part is then termed a "random" signal. This idealized case is shown to constitute but an approximation if applied to the fluctuating field due to first order scattering in a turbulent atmosphere. Therefore, in the second part of the paper the theory is extended to fluctuating contributions (then termed "quasi-random" contributions) not satisfying the above condition of isotropy. All results then depend on two complex correlation functions $a(\tau)$ and $b(\tau)$ instead of on the single function $a(\tau)$ governing the simplified theory. In contrast to $a(\tau)$, the function $b(\tau)$ does not exclusively depend on the energy spectrum of the fluctuating contribution. The fading properties investigated for the composed signal are the distribution functions of both the amplitude and phase, as well as the average number of crossings of each of them (per unit time interval) through any given level. The complicated general formulae reduce to simple expressions in the two extreme cases of (a) absence of the steady signal (e.g. tropospheric scatter propagation to distances far beyond the transmitter's horizon), and (b) predominance of the steady signal (e.g. line of sight propagation to distances well within the horizon). The first limiting case leads, when neglecting the influence of $b(\tau)$ (then being very small), to the well-known Rayleigh distribution for the amplitude, to a homogeneous distribution for the phase, and to a fading rapidity (defined as the average number of crossings per unit time interval through the level most frequently passed) which is for the amplitude faster than for the phase by a factor of 3.04. The second limiting case amounts to normal distributions for both amplitude and phase, and to fading rapidities of these quantities which are only identical insofar as the different behaviour of the in-phase and in-quadrature component (with respect to the steady signal) does have no numerical importance. On the other hand, measurements of the difference in the amplitude-fading rapidity and the phase-fading rapidity will reveal the effect of the asymmetry with respect to the two mentioned components of the scattered signal.

530.19

10637. HYDRODYNAMICS IN A RADIATION FIELD — A COVARIANT TREATMENT. J.Hazlehurst and W.L.W.Sargent.
Astrophys. J., Vol. 130, No. 1, 276-85 (July, 1959).

An expression derived by Synge for the energy-momentum tensor of a photon gas was used to derive the terms which must be added to the hydrodynamical equations of a perfect fluid when the fluid is flowing in a radiation field. The terms of order v/c and $(v/c)^2$ were calculated explicitly and were found to be in agreement with the earlier results of Thomas. The radiative viscosity was found to be twice that predicted by Jeans, while the radiative conductivity is identical with that obtained by applying the results of the kinetic theory to a photon gas.

530.19

10638. GREEN'S FUNCTION FOR THE RESONANCE RADIATION DIFFUSION EQUATION. B.A.Veklenko.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 204-11 (1959). In Russian.

An analytic expression for the Green's function of the resonance radiation diffusion equation is deduced for the case of a homogeneous infinte space. The properties of the Green's function are investigate for a dispersion and Doppler shapes of the spectral lines. An analyt expression is derived for the mean time required for a photon to mo as a result of diffusion over a distance greater than some prescribe value. The Green's function is determined for the stationary equation; for a dispersion shape of the spectral line, its asymptotic expression is given in explicit form.

GENERAL MECHANICS

MECHANICS OF SOLIDS

531.25 : 535.5

10639. USE OF THE PHOTOELASTIC METHOD TO STUDY RESIDUAL CONSTRAINTS. C.Moretti.
Ann. Phys. (Paris), Ser. 13, Vol. 3, No. 9-10, 801-58 (Sept.-Oct., 1958). In French.

In the first part of this paper the mathematical equations governing the residual constraints in a material are derived; they indicate under what conditions an analogy method for the study of the distribution of constraints is possible. The second part is mainly experimental and is concerned with measurements of the birefringence of some photoelastic materials in which residual constraints were produced; the experimental results were in close agreement with those expected from the equations of the first part. In the final part, the photoelastic method is applied to a study of the residual constraints in specimens of certain simple shape and the results are compared with those obtained by other methods. It is concluded that the photoelastic method can profitably be applied to a study of the residual constraints in elastic or plastic materials.

H.J.H.Starks

531.25 : 535.55

10640. ON THE USE OF PHOTOMULTIPLIERS IN PHOTOELASTICITY. J.Sapaly.
C.R. Acad. Sci. (Paris), Vol. 248, No. 17, 2449-51 (April 27, 1959). In French.

The precautions to be taken in photoelastic studies are discussed. These include the stability of the source, the method of wiring up the photomultiplier tube and details on measuring the current. The performances of two tubes are briefly reviewed: they have ten and nine stages respectively. The method of making

measurements to obtain a precision better than 1% for slowly variable or rapid effects of short duration is briefly described. For rapid effects of longer duration the precision is about 3%.

H.G.Jerrard

531.55 : 621.317.39

10641. COMPARISON STUDY BETWEEN A MICROWAVE INTERFEROMETER AND AN ELECTRICAL CONTACT SYSTEM FOR FOLLOWING THE MOTION OF HIGH-SPEED PROJECTILE. Z.I.Slawsky, A.E.Seigel, L.T.Ho, H.J.Kopp and J.T.Vanderslice. Rev. sci. Instrum., Vol. 30, No. 8, 679-83 (Aug., 1959).

A comparison study was made between two different methods of tracking a high-speed missile in a barrel. This comparison between a microwave interferometer and an electrical contact system indicates that there are no systematic errors in either system in the velocity range from 250 m/sec to 425 m/sec. It is pointed out, however, that the microwave system must be used if reliable isentropic pressure v. density curves are to be obtained for the expanding gas behind the missile.

531.577 : 539.63

PITS IN METALS CAUSED BY COLLISION WITH LIQUID DROPS AND SOFT METAL SPHERES. See Abstr. 10339

MECHANICAL MEASUREMENTS

531.714 : 539.4 : 621.317.39

10642. STRAIN GAUGE CALIBRATION DEVICE FOR EXTREME TEMPERATURES. R.M.McClintock. Rev. sci. Instrum., Vol. 30, No. 8, 715-18 (Aug., 1959).

A device is described for applying known static strains to strain gauges under extreme temperature environments. The essential part is a constant strength cantilever beam used in such a way that the mechanical properties of the component parts need not be accurately known. The location of the strain gauges on the beam is not critical since strain is constant along its length. Conditions are given for which errors caused by thermal expansion can be eliminated. Measurements of the strain sensitivity of constantan wire gauges are given at temperatures between 4 and 300° K.

531.786

10643. VARIABLE PERMEABILITY TRANSMISSION DYNAMOMETERS. R.M.Huey. Rev. sci. Instrum., Vol. 30, No. 8, 633-8 (Aug., 1959).

The theory of variable permeability torque measuring devices, such as that described by Beth and Meeks (Abstr. 8942 of 1954), is developed. Certain design requirements and methods for such instruments are set down. Experimental results on an improved version of their instrument are given for torques up to about 75 in. lb in a $\frac{1}{2}$ in. dia. shaft, and indicate that accuracies between 1% and 5% may be expected.

MECHANICS OF FLUIDS

532.133

10644. EFFECT OF POLYDISPERSITY ON NON-NEWTONIAN VISCOSITY OF POLYMERIC SOLUTIONS. M.E.Reichmann. J. phys. Chem., Vol. 63, No. 4, 638-9 (April, 1959).

The viscosity of a polydisperse system is shown to be more shear-dependent than the monodisperse system. The rotatory diffusion constant of the polydisperse system increases with increasing rate of shear. Measurements at relatively high rates of shear must be made if it is desired to evaluate the specific viscosity at a very low rate of shear from combined flow birefringence and viscosity data in polydisperse systems, because the curves for the polydisperse and monodisperse systems do not run parallel. At high extinction angles, the angle has been found to fall off faster with the relative viscosity in the polydisperse system, whereas the two curves have been found to converge again at lower angles. R.Schnurmann

532.137

10645. INTERPRETING ROTATING SPINDLE VISCOMETER DATA. E.B.Fitch. Industr. engng Chem., Vol. 51, No. 7, 889-90 (July, 1959).

A mathematical and graphical procedure is developed which permits the derivation of rheological constants of plastic substances from viscometer data. After calibration of the viscometer (or determination of its constant), readings at several spindle speeds are found. With this information, two graphs can be plotted from which yield values and plastic viscosity can be calculated.

532.513.1

10646. ON THE IMPACT THEORY ON PERFECT INCOMPRESSIBLE FLUIDS. S.I.Gheorghita. Rev. de Physique (Bucarest), Vol. 4, No. 1, 75-84 (1959).

The complex hydrodynamic potential is found in the case of a number of simple two-dimensional impulsive-pressure problems in classical hydrodynamics where a free surface is present.

J.G Oldroyd

532.516

10647. A GAS FILM LUBRICATION STUDY. I. SOME THEORETICAL ANALYSES OF SLIDER BEARINGS. W.A.Gross. I.B.M. J. Res. Develop., Vol. 3, No. 3, 237-55 (July, 1959).

The Reynolds differential equation describing flow in a compressible lubricating film is developed. Important characteristics of such films are determined directly from the Reynolds equation. Pressure, load, velocity, and geometry characteristics are presented for many compressible slider bearing films based upon computer solutions of a Reynolds difference equation as derived in Part II (see following abstract).

532.516

10648. A GAS FILM LUBRICATION STUDY. II. NUMERICAL SOLUTION OF THE REYNOLDS EQUATION FOR FINITE SLIDER BEARINGS. W.A.Michael. I.B.M. J. Res. Develop., Vol. 3, No. 3, 256-9 (July, 1959).

Presents a finite-difference technique for obtaining approximate numerical solutions to the Reynolds partial differential equation of gas film lubrication theory. A digital computer programme is described, and discretization errors and stability of the difference equation are discussed.

532.516

10649. A GAS FILM LUBRICATION STUDY. III. EXPERIMENTAL INVESTIGATION OF PIVOTED SLIDER BEARINGS. R.K.Brunner, J.M.Harker, K.E.Haughton and A.G.Osterlund. I.B.M. J. Res. Develop., Vol. 3, No. 3, 260-74 (July, 1959).

The experimental methods are described, and the experimental data are compared with data obtained from a numerical solution of the Reynolds differential equation for a compressible fluid.

532.516

10650. GENERAL SOLUTION OF REYNOLDS EQUATION FOR A JOURNAL BEARING OF FINITE WIDTH. L.N.Tao. Quart. appl. Math., Vol. 17, No. 2, 129-36 (July, 1959).

532.517

10651. EFFECT OF BUOYANCY FORCES ON CERTAIN VISCOUS FLOWS WITH SUCTION. A.S.Gupta. Appl. sci. Res. A, Vol. 8, No. 4, 309-20 (1959).

The effect of gravity on the unsteady flow of a viscous incompressible fluid due to the motion of an inclined infinite porous flat plate along its line of greatest slope is discussed. The boundary layer equations are integrated for two cases: (1) when the suction velocity at the plate is constant; (2) when the suction velocity at the plate is inversely proportional to the square root of time. Explicit expressions for velocity and temperature distribution are given in both the cases for any σ (Prandtl number). In the case of a uniformly accelerated plate, it is found that for $\sigma = 1$ and suction velocity proportional to $t^{-1/2}$, the velocity increases with the non-dimensional parameter $\beta g \sin \alpha$. $(T_w - T_\infty)/D$ and the skin friction at the plate is proportional to the square root of time. It is found that in the case of the free convection flow of a compressible fluid past an infinite flat plate subjected to suction the skin friction at the plate increases with gravity and decreases with suction.

532.517

10652. APPLICATION OF A RECIPROCAL PROPERTY TO SUBSONIC FLOW. G.Power and P.Smith. Appl. sci. Res. A, Vol. 8, No. 5, 386-92 (1959).

A reciprocal property for the two-dimensional, irrotational flow of a compressible fluid is derived. From this certain flows can be obtained which possess the property of having simply-related velocity potentials and stream functions. To each flow pattern there corresponds a certain pressure density law. Using this property, an approximation method for subsonic flow is deduced, and an example is given which indicates that satisfactorily accurate results can be achieved.

532.517.2

10653. ON THE FLOW OF A VISCOUS FLUID PAST A THIN SCREEN AT SMALL REYNOLDS NUMBERS. H.Hasimoto.
J. Phys. Soc. Japan, Vol. 13, No. 6, 633-9 (June, 1958).

The slow steady flow of a viscous incompressible fluid past a thin screen with holes or slits is investigated on the basis of the Stokes equations of motion. It is found that the flow conductance σ of the holes or slits (i.e. the ratio of the total flow Q to the pressure drop P) is given by $\sigma = Q/P = M/8\rho\mu$ where ρ is the density of the fluid, μ the viscosity, and M the virtual mass of disks or strips which are congruent with the holes or slits, moving broadside-on in a perfect fluid. The drag D acting on a part of the wall δW of the screen is also given by $D = Pq_p$, where q_p is the total flow of the perfect fluid through δW in this movement with unit velocity. As examples, the cases of a single elliptic hole, a single slit, two parallel equal slits, and a series of parallel equal and equidistant slits are considered. Especially, in the last case, the total drag for an intervening strip is shown to be $4\pi\mu U/\log|\cos(\epsilon\pi/2)|$ where U is the velocity of the viscous fluid at infinity, and ϵ the relative aperture of the screen ($0 < \epsilon < 1$).

532.517.2

10654. PHENOMENOLOGICAL FREE STREAMLINE THEORY. I. FLOW PAST A NORMAL PLATE. Y.Mimura.
J. Phys. Soc. Japan, Vol. 13, No. 11, 1361-74 (Nov., 1958).

The pressure distribution on a normal plate is determined by the pressure distribution on a free streamline which is obtained as a function of the distance from the separation point. In the case where the latter is obtained only in the "free streamline range" (e.g., the range from the separation point to a distance equal to about one and a half the breadth of the plate), the pressure distribution and other quantities on the normal plate are estimated with their probable deviations. The shape of the free streamline is also examined.

532.517.4

10655. RESEARCH INTO A NEW THEORY CONCERNING THE ORIGIN OF TURBULENCE. D.Ullmann.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 5-6, 316-22 (1959). In German.

The stability of streamline flow between parallel plates is investigated by the method of perturbing oscillations. As distinct from previous similar attempts, the oscillations are assumed to be sound waves involving fluctuations of the density. The damping of the waves in space (rather than in time) of the waves provides a criterion of stability, so that "negative damping" indicates turbulence. The complex propagation vector of the wave is determined by an algebraic equation of the 5th degree. Four solutions correspond to waves with decreasing amplitudes. One solution corresponds to a wave the amplitude of which tends to increase if Reynold's number is high enough. The existence of such waves is a possible explanation of the breakdown of laminar flow. R.Eisenschitz

532.517.4

10656. COMMENTS ON "SPACE–TIME CORRELATIONS IN STATIONARY ISOTROPIC TURBULENCE". R.H.Kraichnan.
Phys. of Fluids, Vol. 2, No. 3, 334 (May-June, 1959).

A reply to the critisisms made by Münch and Wheelon (Abstr. 2127 of 1959) of Kraichnan's previous analysis (Abstr. 4782 of 1958). J.G.Oldroyd

532.525

10657. CONTRIBUTION TO THE THEORY OF [LIQUID] JET ATOMIZATION. G.Sitkei.
Acta tech. Hungar., Vol. 25, No. 1-2, 87-117 (1959). In German.

The external and internal forces acting upon the jet are treated. It is shown that the decomposition into drops is caused mainly by the intensive low-frequency turbulent pulsation acting as an internal force, and the subsidiary dynamic force, arising on the front surface of the moving drops (as an external force). Quantitative relations are deduced for the mean drop diameters. The conditions of jet movement are discussed further and a characteristic function is found describing correctly the movement conditions of the jet as a function of various parameters. A method for an approximate determination of fuel distribution is given.

532.525

10658. STABILITY CONSIDERATIONS ON NONVISCOUS JETS EXHIBITING SURFACE OR BODY TENSION. P.Debye and J.Daen.
Phys. of Fluids, Vol. 2, No. 4, 416-21 (July-Aug., 1959).

The question of the range of ejected liquid streams is connected with the relation of the stability of the jet motion to an initial infinitesimal disturbance. This is investigated as a theoretical problem for the planar and cylindrical cases neglecting any fluid viscosity. In addition, the stabilizing influence of either a surface or "body tension" is calculated. Comparison of the theory with some publish data is found to yield qualitative and semiquantitative agreement. The possibility of applying this theory to the measurement of dynam surface tensions is suggested.

532.52

10659. RADIATION-INDUCED CAVITATION. D.Lieberman.
Phys. of Fluids, Vol. 2, No. 4, 466-8 (July-Aug., 1959).

Measurements of the threshold of radiation-induced acoustic cavitation in pentane and acetone are described. A resonator metho was employed. It is concluded that the observed cavitation was nucleated by recoil carbon ions in pentane. The results are compared with calculations based on Seitz's model of the nucleation process. The agreement is within an order of magnitude.

532.542.

10660. ENTRANCE EFFECTS AND PREDICTION OF TURBULEN IN NON-NEWTONIAN FLOW. D.C.Bogue.
Industr. engng Chem., Vol. 51, No. 7, 874-8 (July, 1959).

The development of the velocity profile at the entrance of a pip is studied, with special reference to methods of predicting pressure drops and entrance (calming) lengths. The fluid's rheological behaviour is described by a power law. A boundary layer method is used, in which von Kármán's integrals are transformed to cylindrical coordinates. A non-Newtonian length Reynolds number is shown to be the criterion in determining turbulence at the pipe's entrance. Experimental data are presented.

532.5

10661. HEAT-BALANCE FLOWMETER FOR MOLTEN BISMUTH. D.W.Huszagh.
Nucleonics, Vol. 17, No. 3, 114, 115 (March, 1959).

A flowmeter for use in a $\frac{1}{2}$ in. piping system for flows up to 10 ft/sec. Two 2 kW immersion electric heaters are fitted in the sides of a flattened section of pipe. Thermocouples before and after the heating section measure the temperature rise and hence the flow-rate. R.D.Smit

532.570.

10662. A REMOTELY OPERATING FLOW METER. N.S.Korshunov and M.V.Khatskevich.
Internat. J. appl. Radiation and Isotopes, Vol. 4, No. 1-2, 121-3 (Dec., 1958). Translated from Atomnaya Energiya. In Russian.

A rotameter with a radioactive float can be used for the measurement of small flow rates. This has been done by inserting the rotameter into a concentric cylinder ionization chamber whose outside cylinder consists of two parts of equal length. When opposi potentials are applied to these two parts of the electrode no current will flow when the float is in the centre of the chamber. Flow rates of 0.015-0.06 litre/hr of carbon tetrachloride and 0.2-2 litre/hr of water have been measured with an error of ±2.5%. In these experiments a teflon float has been used, containing, as a γ-ray source, a wire of Co^{60} of 0.7-0.8 mm diameter. The strength of this source was 2-5 mc. R.Schnurmann

532.570.8 : 534.321.

10663. THE ULTRASONIC FLOWMETER. R.E.Fischbacher.
Trans. Soc. Instrum. Technol., Vol. 11, No. 2, 114-19 (June, 1959).

The principles of operation of several flowmeters are reviewe The limitations of each and the conditions under which each might be applicable are discussed.

532.570.

10664. MASS FLOWMETERS. P.Scanes.
Trans Soc. Instrum. Technol., Vol. 11, No. 2, 119-23 (June, 1959).

Instruments for measuring mass-flow of fluids may be classified into those that give true mass-flow independently of the compo sition of the fluids, and those that work with one fluid whose mass-flow can be calculated approximately from the outputs of standard industrial flow, pressure, and temperature instruments. The paper describes various instrument designs in each of these classes.

532.570.8 : 538.52

10665. THE MAGNETIC FLOWMETER. B.W.Balls and K.J.Brow
Trans Soc. Instrum. Technol., Vol. 11, No. 2, 123-30 (June, 1959).

Describes the principle of operation and the history of develop ment, gives some examples of the applications, and lists the applic ation restrictions. The design of a commercially available instrument is given in detail.

532.570.8

10666. PROPELLER FLOWMETERS WITH ELECTRONIC INDICATION. F.R.Allen.
Trans Soc. Instrum. Technol., Vol. 11, No. 2, 131-6 (June, 1959).

The principles are described and industrial applications indicated. Various types of pickup and various measuring systems are described. In its simplest form the meter measures volumetric flow; it is shown how the instrument may be made to give mass flow by applying density corrections, either by inferential measurement of density from temperature, or by direct measurement.

532.58

10667. OSCILLATION OF THE WAKE BEHIND A FLAT PLATE PARALLEL TO THE FLOW. S.Taneda.
J. Phys. Soc. Japan, Vol. 13, No. 4, 418-25 (April, 1958).

Oscillation of the pure laminar wake behind a flat plate placed in a uniform stream at zero incidence angle was investigated experimentally at Reynolds numbers between 10^2 and 10^5. (The Reynolds number R is Ul/ν, where U is the model speed, l is the plate length and ν is the kinematic viscosity). For a sufficiently small R the corresponding wake was perfectly laminar and there was no vortex filament. But when R of about 700 was reached, the wake began to oscillate sinusoidally some distance downstream. As R was increased further the oscillation became more and more conspicuous and discrete vortex filaments appeared in the loop of the sinusoidal wave. Frequency N was measured by the hot-wire technique and it was found that the Strouhal number Nl/U is nearly proportional to 1/2 power of R. On the other hand, wavelength λ was determined from the photographs taken by the aluminium dust method, and the relation between l/λ and R was obtained. Spacing ratio and velocity of the vortex filaments were also estimated. These experimental results were compared with those of the wakes behind various bluff bodies, and some knowledges about the origin of oscillation of the wake were obtained. The value of wake Strouhal number was nearly constant for all shapes of body, while the wave velocity changed remarkably with the shape of the body.

532.582

10668. THE FORCES EXPERIENCED BY A LATTICE OF EQUAL FLAT PLATES IN A UNIFORM FLOW AT SMALL REYNOLDS NUMBERS. S.Kuwabara.
J. Phys. Soc. Japan, Vol. 13, No. 12, 1516-23 (Dec., 1958).

Two-dimensional incompressible viscous flow past a lattice of equal parallel and equidistant flat plates without stagger placed parallel to a uniform flow is studied on the basis of Stokes' approximation by use of the Fourier transformation method. Asymptotic solutions are explicitly obtained for two cases $h \to \infty$ and $h \to 0$, where h is the distance between two neighbouring flat plates.

532.59

10669. THE EFFECT OF PASSING A LINEAR PLANE WAVE OVER A STEP. K.Takano.
C.R. Acad. Sci. (Paris), Vol. 248, No. 12, 1768-71 (March 23, 1959). In French.

Series solutions can be obtained for the velocity potentials upstream of, above, and downstream of a rectangular block placed on the horizontal bottom of a channel, on the basis of a linearized two-dimensional theory. J.G.Oldroyd

532.59

10670. INSTRUMENT FOR MEASURING WATER WAVES. C.G.Whittenbury, E.A.Huber and G.S.Newell.
Rev. sci. Instrum., Vol. 30, No. 8, 674-6 (Aug., 1959).

The variation of wave height is sensed by a probe whose capacitance is linearly dependent on wave height and controls the repetition rate of a blocking oscillator. The variation of repetition interval is converted into amplitude modulation at the recording site. The wide dynamic range (1000 : 1) of the electronic portion of the instrument permits the measurement of ripples with the same accuracy whether they are on calm or rough water. The dynamic range of the instrument is limited by the characteristics of the probe. The instrument requires no balancing, has a frequency range from 0 to 100 c/s and a sensitivity which is adjustable. The maximum sensitivity used in the field was 8.0 V/cm water displacement and the noise level at this sensitivity corresponds to 0.032 mm r.m.s. water displacement.

532.592

10671. PROPAGATION OF TRANSVERSE WAVES ON VISCOELASTIC JETS. J.Gavis.
Industr. engng Chem., Vol. 51, No. 7, 885-6 (July, 1959).

A technique has been developed by which the relaxing tensile stress in the jet as it leaves the nozzle can be measured by wave propagation. This technique is discussed with special reference to the general problem of wave propagation in jets. It is shown that if the shear modulus of the liquid at the propagation frequency is in the range from 10^3 to 10^4 dyn/cm^2, then the propagation can be described by comparatively simple equations.

532.65

10672. FALL OF LIQUID DROPS THROUGH PSEUDOPLASTIC LIQUIDS. M.V.Mhatre and R.C.Kintner.
Industr. engng Chem., Vol. 51, No. 7, 865-7 (July, 1959).

The behaviour of the drops can be predicted from conventional drag curves, if it is assumed that the apparent viscosity of a pseudoplastic liquid for a given drop size is the same as that of a Newtonian liquid through which a drop of the same size, density difference and interfacial tension will fall with the same terminal velocity. The average shear rates for falling drops can be found by applying viscometer data to a power law equation. Observations are reported on the distortion of drops from prolate forms to classical tear shape. The drop size at which the shape changes is a function of apparent viscosity.

532.65

10673. ON THE BEHAVIOR OF LIQUID DROPLETS AFTER IMPINGING ON SOLID SURFACES. I.Gallily and V.K.La Mer.
J. phys. Chem., Vol. 62, No. 10, 1295-9 (Oct., 1958).

The deposition of particles impinging on solid surfaces was investigated for a system composed of a two-dimensional jet of glycerol aerosol and Desicote-coated glass microscope slides inclined to it. The patterns of the particles deposited in these experiments were found to change with the velocity of the jet and the radius of the areosol contrary to the way usually expected. They indicate that a certain fraction of the particles bounces off from the surface on first contact. A qualitative explanation of the phenomena found is offered.

MOLECULAR THEORY OF LIQUIDS

532.7

10674. ON THE THEORY OF FLUIDS. K.Hiroike.
J. Phys. Soc. Japan, Vol. 13, No. 12, 1497-503 (Dec., 1958).

A "netted ring approximation" is proposed. Several thermodynamic properties are derived by means of this approximation. The radial distribution function is also derived, the expression of which is similar to one based on the netted chain approximation of Rushbrooke and Scoins. The possibility of a phase change in a gas of hard spheres is pointed out.

532.7

10675. TRANSPORT PROPERTIES IN THE LIQUID STATE AND THE CORRESPONDING STATE PRINCIPLE. G.Cini-Castagnoli, G.Pizzella and F.P.Ricci.
Nuovo Cimento, Vol. 11, No. 3, 466-7 (Feb. 1, 1959).

An examination of the extent to which the transport properties of the "near perfect" liquids agree with the corresponding state principle. Deviations from the perfect liquid (argon) are greater for transport properties than for equilibrium properties. It is found that even for transport processes the principle can be satisfactorily applied to N_2, CO and to a lesser extent to CH_4 and O_2. T.C.Toye

532.72

10676. THE VALUES OF THE ACTIVATION ENERGY OF SELF-DIFFUSION IN LIQUID METALS. K.A.Osipov.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 6, 1019-20 (1958). In Russian.

The author proposes a quantitative relation between the activation energy as derived from the temperature effect on self-diffusion or viscosity in the liquid state and quantities derived from the properties of the solid metal. The formula is tested against data for sodium, tin, aluminium, magnesium, lead and iron. Agreement is good. R.Eisenschitz

532.72

10677. EVALUATION OF DIFFUSION COEFFICIENTS FROM SEDIMENTATION VELOCITY MEASUREMENTS. H.Fujita.
J. phys. Chem., Vol. 63, No. 7, 1092-5 (July, 1959).

For two-component systems in which the sedimentation coefficient s is a linear function of solute concentration C, a procedure is developed which permits determination of the diffusion coefficient

D from sedimentation velocity measurements. The basis of the development is an approximate equation derived recently by Fujita for the height-area ratio of the sedimentation boundary curves in such systems. This procedure is tested by using the height–area data of Baldwin (1957) for bovine plasma albumin, and it is found that the values of D computed by the present method agree satisfactorily with those predicted from the free diffusion experiment of Gosting.

532.72

10678. SHAPE-PRESERVING SOLUTIONS OF THE TIME-DEPENDENT DIFFUSION EQUATION. F.S.Ham.
Quart. appl. Math., Vol. 17, No. 2, 137-45 (July, 1959).

Exact solutions to the time-dependent diffusion equation are exhibited, which correspond to the diffusion-limited growth of ellipsoidal precipitate particles with constant shape and dimensions proportional to the square root of the time. The asymmetry of the diffusion field in these solutions is consistent with the preservation of the particle's shape during growth even if the diffusivity is anisotropic. Limiting cases for simpler geometries are derived and shown to be in agreement with previously known results for radially symmetric particles and isotropic diffusion. Similar solutions for hyperboloidal surfaces are exhibited and generalizations are considered analogous to those discussed by Danckwerts (1950) for one-dimensional diffusion.

532.73 : 541.124

10679. A DIFFUSION PROBLEM WITH CHEMICAL REACTION. H.A.Lauwerier.
Appl. sci. Res. A, Vol. 8, No. 5, 366-76 (1959).

A substance is subjected to cylindrical Poiseuille flow, diffusion and a chemical reaction. The stationary state is considered. It is assumed that the axial component of the diffusion can be neglected. Then the problem can be reduced to an eigenvalue problem determining an orthogonal set of eigenfunctions. Also a simplified model is considered where the cylindrical wall is replaced by a flat wall. This problem can be solved by means of Laplace transformation. An explicit solution for the concentration at the wall has been obtained.

532.74 : 535.435

10680. EVIDENCE FOR FORMATION OF MOLECULAR GROUPS IN LIQUIDS AT LOW TEMPERATURES. G.S.Kastha.
Indian J. Phys., Vol. 32, No. 10, 473-82 (Oct., 1958).

The intensity distribution in the wing accompanying the Rayleigh line scattered by pyridine, α-picoline, o-cresol, o-chlorophenol and p-xylene at temperatures near about the freezing points of the liquids was studied by the method of photographic spectrophotometry and compared with that observed at higher temperatures in each case. In all cases the intensity of the wing in the region from the centre of the Rayleigh line up to a distance of about 25 cm^{-1} decreases with the lowering of temperature and at the lower temperature additional intensities from new sources appear in the wing at distances beyond 45 cm^{-1} from the Rayleigh line. The intensity of the wing beyond 45 cm^{-1} due to the liquid at low temperatures has been compared with the intensity of the low-frequency Raman lines observed in the region 45-137 cm^{-1} in the spectra due to the frozen liquids. It has been concluded that the additional intensity mentioned above may arise from vibration in groups of loosely attached molecules formed in the liquid near its freezing point and that the size of these groups and also the strength of the intermolecular bond in the groups increase with solidification of the liquid.

532.77

10681. VARIATION OF HUGGIN'S CONSTANT WITH SOLVENT POWER FOR POLYMETHYL METHACRYLATE SOLUTIONS. V.V.Vardaiah and V.S.R. Rao.
Curr. Sci., Vol. 28, No. 2, 61-2 (Feb., 1959).

For polymethyl methacrylate of molecular weight about 404 000 Huggin's constant has been found to decrease with increasing solvent power of a number of liquids of which all but pyridine obey a straight-line relationship between $k''[\eta]^2$ and $k'[\eta]^2$ and $[\eta]$ (k' = Huggin's $[\eta]$ = intrinsic viscosity). R.Schnurmann

532.77 : 536.7

10682. THE VOLUMETRIC AND THERMODYNAMIC PROPERTIES OF FLUIDS. V. TWO COMPONENT SOLUTIONS. K.S.Pitzer and G.O.Hultgren.
J. Amer. Chem. Soc., Vol. 80, No. 18, 4793-6 (Sept. 20, 1958).

The acentric factor theory of volumetric behaviour of pure fluids is applied to mixed gases. The pseudo-critical temperature and pressure and the acentric factor are evaluated for twelve binary systems each at several compositions. It is found that a linear equation in the mole fraction and the properties of the components is adequate for the acentric factor in all cases and for the pseudo-critical temperature and pressure. The relationship of these quadratic terms to the intermolecular forces is considered. It is believed that useful predictions of fugacities as well as of volumetric data can be made on the basis of these results. For previous part see Industr. engng Chem., Vol. 50, No. 2, 265 (Feb., 1958).

532.77

10683. EFFECT OF VELOCITY GRADIENT ON THE RADIAL DISTRIBUTION OF POLYMER MOLECULES IN DILUTE SOLUTION. R.Koyama.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1167-73 (Oct., 1958).

A differential equation which determines the time dependence of the radial distribution function of polymer molecules in dilute solution is derived. The equation is represented in a form of a diffusion equation. For the case in which the solution is flowing with a constant velocity gradient, and the system is at a steady state, a calculation is carried out, adopting a Gaussian intermolecular potential between free-draining chain-polymer molecules. The result shows that the velocity gradient in the solution causes the radial distribution function to be deformed into a nonspherical symmetry, and this deformation is increased with the increase of the velocity gradient and the molecular weight of polymer.

532.77 : 535.435

RAYLEIGH SCATTERING OF LIGHT BY SOLUTIONS IN THE ABSORPTION-BAND REGION. See Abstr. 9530

MECHANICS OF GASES
VACUUM TECHNIQUE

533.15

10684. GAS OCCLUSION IN IRREVERSIBLE SOLID-STATE DECOMPOSITION. G.Gafner.
Trans Faraday Soc., Vol. 55, Pt 6, 981-4 (June, 1959).

The theory of diffusion of internally generated gas through spherical particles is given. The results are plotted for values of th parameters approximating those encountered in small particle irreversible decomposition studies. It is shown that when the operativ diffusion constant is smaller than 10^{-11} cm^2 sec, appreciable delay between gas generation and its escape will occur. The relevance of this result to irreversible thermal decomposition and radiation induced decomposition is discussed.

533.16 : 538.5

10685. VARIATION OF THE VISCOSITY OF SOME GAS AND OXYGEN MIXTURES UNDER THE INFLUENCE OF A MAGNETIC FIELD. I.Ursu.
Rev. de Physique (Bucarest), Vol. 3, No. 3, 227-38 (1958).

The viscosity of gaseous oxygen is observed to decrease when a uniform magnetic field (3500 Oe) is applied. The effect is decreased when hydrogen is present, and increased when methane is present, in gaseous mixtures. Relative variations can be observed continuously, using a blade microgauge, and the effect can be used to determine concentrations of certain oxygen–gas mixtures with about 0.5% error. J.G Oldroyd

533.5

10686. DUAL PUMPING SPEEDS OF SOME IONIZATION PUMPS. G.Carter.
Nature (London), Vol. 183, 1619-20 (June 6, 1959).

Experiments were carried out using an ion pump of the type first proposed by Cosma and Musa. Two distinct pumping speeds were detected dependent on whether the glass walls of the pump assumed the potential of the cathode or the anode; in pumps which had not been well outgassed either speed could be obtained by a suitable electrode potential switching sequence. R.D.Hudso

533.6.011 : 536.

10687. A HEATING MECHANISM IN GAS EXPANSION. L.J.F.Broer.
Appl. sci. Res. A, Vol. 7, No. 6, 476-8 (1958).

From the basic equation of gas dynamics, a simple deduction shows that in an expanding flow the total enthalpy can be higher than the reservoir enthalpy before expansion. S.Weintroub

533.6.011.3

10688. APPROXIMATE SUBSONIC GAS FLOWS UNDER ASSIGNED BOUNDARY CONDITIONS. G.Power and P.Smith.
Appl. sci. Res. A, Vol. 8, No. 5, 349-56 (1959).

The solution to compressible flow problems under fully assigned boundary conditions is discussed. It is shown that Schwarz's results on minimal surfaces can be immediately applied for two-dimensional flow, and several special cases and examples are given. Extensions of these results provide certain particular types of three-dimensional flow.

533.6.011.3

10689. SOME NONLINEAR EFFECT IN COMPRESSIBLE FLOW. H.Moriguchi.
J. Phys. Soc. Japan, Vol. 13, No. 12, 1510-16 (Dec., 1958).

The two-dimensional potential flow of a compressible fluid past a family of cylindrical obstacles with two parameters which includes an elliptic cylinder and a Kaplan bump is investigated by use of Imai's method. An interesting example has been found such that the surface velocity distribution changes its character with increasing Mach number, namely, it has two maxima for M = 0, which tend to coalesce into one as the Mach number increases. Such an effect, however, is very small within the approximation used.

533.6.011.3

10690. ON THE EXISTENCE OF POINTS WITH INFINITE ACCELERATION ON THE CONTOURS OF AEROFOILS WITH FINITE CURVATURE IN TRANSONIC FLOW. S.Nocilla.
R.C. Accad. Naz. Lincei, Vol. 26, No. 2, 197-206 (Feb., 1959).
In Italian.

The formation of shock waves is associated with the occurence of points of infinite acceleration rather than with the appearance of limiting lines. An examination is made of the behaviour of the stream function in the hodograph plane when the flow in the physical plane is such that the aerofoil profile is of finite curvature and the tangential acceleration of fluid particles becomes infinite at a point on the profile, the flow remaining regular in the neighbourhood of this point. R.A.Newing

533.6.011.4

10691. FLOW PAST A BENT FLAT PLATE WITH AN UNSYMMETRIC DEAD AIR AT MACH NUMBER 1. T.Sakurai.
J. Phys. Soc. Japan, Vol. 13, No. 9, 1055-60 (Sept., 1958).

The ideal case of the flow past a bent flat plate with an unsymmetric dead air region at Mach number 1, in which a streamline comes tangentially to the plate at its leading edge, is discussed by means of the simple procedure of Imai's W.K.B. method. Numerical results are given for several values of the form parameter.

MOLECULAR THEORY OF GASES

533.7 : 536.23

10692. THERMAL CONDUCTIVITY OF MULTICOMPONENT GAS MIXTURES. II. E.A.Mason and S.C.Saxena.
J. chem. Phys., Vol. 31, No. 2, 511-13 (Aug., 1959).

For Pt I, see Abstr. 5715 (1958). An investigation is made of the accuracies of the two recently derived formulae for the translational thermal conductivity of multicomponent gas mixtures. It is found that neither formula is sufficiently accurate in all cases, but that a slight modification of the Muckenfuss–Curtiss formula (see Abstr. 1365 of 1959) makes it as accurate as current experimental measurements. The modification consists of the replacement of first approximations to binary diffusion coefficients by more accurate values.

533.7

10693. KINETIC MODELS AND THE LINEARIZED BOLTZMANN EQUATION. E.P.Gross and E.A.Jackson.
Phys. of Fluids, Vol. 2, No. 4, 432-41 (July-Aug., 1959).

Attention is directed to some unsatisfactory features of kinetic theory treatments of problems for which the linearized Boltzmann equation is applicable. The main defects are in the region where nearly free molecular flow conditions prevail. They can be overcome when the problems are treated by simplified kinetic models. In this paper relations between the linearized Boltzmann equation and some models are established. The method is based on a comparison of the eigenvalue spectra of the respective collision operators. Particular attention is paid to inverse fifth molecules. This allows evaluation of the limitations of a given model and shows how more accurate models can be constructed. It is shown how one may overcome the chief shortcomings of approximate solutions of the linearized Boltzmann equation.

533.7 : 539.19

10694. ROTATIONAL AND VIBRATIONAL RELAXATION IN DIATOMIC GASES. J.G.Parker.
Phys. of Fluids, Vol. 2, No. 4, 449-62 (July-Aug., 1959).

Calculations of rotational and vibrational relaxation times for gases composed of homonuclear diatomic molecules were carried out. The model used for the molecular interaction potential consists of an attractive component, which acts between geometrical centres of the molecules, and a repulsive component which is assumed to originate from two centres of force in each of the molecules. For large intermolecular separations, the attractive forces prevail while at close distances the repulsive forces control. Using this model, the number of collisions to establish rotational equilibrium Z_R and also the number for vibration Z_V are calculated. Both Z_R and Z_V contain some of the same molecular parameters and are therefore dependent on each other. From the analysis it turns out that Z_R is a gradually increasing function of increasing temperature and Z_V is a rapidly decreasing function of increasing temperature. Comparison with experiment for the gases chlorine, nitrogen, and oxygen indicates that the calculations are for the most part reliable.

533.7 : 534.222.2

EXACT SOLUTIONS OF CERTAIN GAS-DYNAMICAL EQUATIONS. See Abstr. 9323

533.7 : 539.19

SEPARATION OF GAS MIXTURES IN A SUPERSONIC JET. See Abstr. 10217

VIBRATIONS . ACOUSTICS

534.01

10695. MATRIX DIFFERENTIAL SYSTEMS WITH A PARAMETER IN THE BOUNDARY CONDITIONS AND RELATED VIBRATION PROBLEMS. J.Adem.
Quart. appl. Math., Vol. 17, No. 2, 165-72 (July, 1959).

Following Moshinsky's method (Abstr. 4688 of 1951) of describing vibratory processes by a column matrix or a vector instead of a single function, the author takes a more general eigenvalue problem, containing a parameter both in the differential equations and in the boundary conditions. Examples of vibratory systems are described, giving rise to this new type of eigenvalue problem (e.g. vibrating string with a concentrated mass at a point); finally, a general matrix differential system is formulated and discussed in order to obtain properties of eigenvalues and of eigen-column matrices, defined in the paper. J.K.Skwirzynski

534.112 : 621.315.174

10696. EIGENOSCILLATIONS OF AN ELASTIC CABLE. P.Laasonen.
Quart. appl. Math., Vol. 17, No. 2, 147-54 (July, 1959).

The eigenoscillations of a cable, supported at its end points, in a homogeneous gravitational field is investigated under the assumption that the bending stiffness is negligible but the behaviour with respect to tension stresses is perfectly elastic. The problem involves two coupled second-order equations and one independent second-order equation; it is shown to be definitely self-adjoint and an iterative method for its solution is suggested. In the particular case of a cable with negligible sag, the asymptotic eigenvalves are obtained. It turns out that the gravitational field has such a "stiffening" effect that the eigenvalues related to some oscillation modes may be substantially greater (the lowest of them eightfold) than those given in the classical theory on vibrating strings.

534.131 : 550.3

TORSIONAL OSCILLATIONS OF ELASTIC SPHERES. See Abstr. 10404

534.142

10697. ANALYSIS OF HEAT-DRIVEN OSCILLATIONS OF GAS FLOW. II. ON THE MECHANISM OF THE RIJKE-TUBE PHENOMENON. H.J.Merk.
Appl. sci. Res. A, Vol. 6, No. 5-6, 402-20 (1957).
For Pt I, see Abstr. 4369 (1959).

534.142

10698. ANALYSIS OF HEAT-DRIVEN OSCILLATIONS OF GAS-FLOWS. III. CHARACTERISTIC EQUATION FOR FLAME-DRIVEN OSCILLATIONS OF THE ORGAN-PIPE TYPE. IV. DISCUSSION OF THE THEORETICAL RESULTS CONCERNING FLAME-DRIVEN OSCILLATIONS. H.J.Merk.
Appl. sci. Res. A., Vol. 7, No. 2-3, 175-91, 192-204 (1958).

534.142

10699. ANALYSIS OF HEAT-DRIVEN OSCILLATIONS OF GAS FLOWS. V. INFLUENCE OF HEAT TRANSFER IN THE BURNER PORTS ON THE STABILITY OF COMBUSTION OF PREMIXED GASES. H.J.Merk.
Appl. sci. Res. A, Vol. 8, No. 1, 1-27 (1958).

534.15

10700. DYNAMIC FORCE MEASURING SYSTEM FOR MACHINERY VIBRATION WITH PARTICULAR APPLICATION TO BALANCING OF ASSEMBLED MACHINES.
T.W.Barraclough, R.D.Collier and A.C.Summers.
J. Acoust. Soc. Amer., Vol. 31, No. 8, 1104-7 (Aug., 1959).

The dynamic force measuring system for the measurement of machinery vibration is based on the use of four piezoelectric force transducers. These transducers are installed between the feet of the machine under test and a terminating foundation, preferably a large seismic mass. The four signals are combined in two ways: (1) as a phasor sum to provide a single vertical force measurement and (2) as a sum and difference with equivalent moment arms to provide torque measurements. These fundamental measurements are based on force and torque equations developed from the six motions of an assumed rigid body. At the fundamental frequency of machinery vibration the two combined signals provide a measure of static and dynamic unbalance. The force spectrum may be analysed by conventional means to provide frequency and amplitude information.

534.2

10701. RAYLEIGH-WAVE DISSIPATION FUNCTIONS IN LOW-LOSS MEDIA. J.R.Macdonald.
Geophys. J., Vol. 2, No. 2, 132-5 (June, 1959).

A simple formula is derived relating the specific dissipation factors for Rayleigh, compressional, and shear waves in relatively low-loss materials. Calculations and a table are presented which allow an unknown specific dissipation factor to be obtained directly from the two known factors for the other types of wave. Results apply for any realizable ratio of any two of the three elastic phase velocities.

534.2

10702. OBSERVATION CONCERNING THE ATTENUATION OF ELASTIC WAVES IN THE GROUND. C.M.Harris and L.Kirvida.
J. Acoust. Soc. Amer., Vol. 31, No. 7, 1037-8 (July, 1959).

A few measurements are quoted of the attenuation, measured on the ground surface at distances up to 1000 ft, of vibrations generated by a source acting on the surface. The vibrating source was an earth-packing machine consisting of a single-cylinder petrol engine geared to an eccentric mass; this imparted considerable energy to the ground and its frequency could be altered. An example is given of the considerable differences in attenuation that occur at particular distances from the source, depending on inhomogeneities and reflections from sub-surface boundary layers.

H.J.H.Starks

534.22

10703. STUDY OF ULTRASONIC VELOCITY IN ORGANIC SOLUTIONS. B.Ramachandra Rao and K.Subba Rao.
Curr. Sci., Vol. 28, No. 3, 108-9 (March, 1959).

The velocity in solutions of benzoic acid in chloroform, benzene, and ethyl alcohol was measured using a variable-frequency fixed-path interferometer. The variation of the velocity with concentration is almost linear. The value (extrapolated) for 100% concentration does not correspond to the value in the pure solid solute.

W.Good

534.22 : 532.7

10704. VELOCITY OF ULTRASONIC WAVES IN SOLUTIONS OF ELECTROLYTES. S.Prakash and S.C.Srivastava.
Indian J. Phys., Vol. 32, No. 2, 62-5 (Feb., 1958).

An equation for the velocity of ultrasonic waves in solutions of electrolytes has been developed on the basis that electrostatic forces between the ions increase the pressure, whereby the volume elasticity is increased, and therefore the velocity.

534.22

10705. DEVIATION FROM LINEARITY OF THE CONCENTRATION DEPENDENCE OF THE MOLECULAR SOUND VELOCITY IN LIQUID MIXTURES. O.Nomoto.
J. Phys. Soc. Japan, Vol. 13, No. 12, 1524-8 (Dec., 1958).

Accuracy of the linear dependence of molecular sound velocity on the molar fractions of the component liquids was investigated in about 100 binary mixtures, employing existing ultrasonic data. The linearity proved to hold true within an accuracy of 0.3% for mixtures of two hydrocarbons or two monovalent alcohols, among others, while the deviation from linearity was larger (0.3%-4%) for the following mixtures: aqueous solutions, mixtures containing one heavy component such as carbon tetrachloride or chloroform with light partners, mixtures containing glycerine, glycol, aniline, acetone, nitrobenzene, etc. The molecular compressibility (of Wada) showed a similar tendency, though the deviation from linearit was somewhat smaller than that of the molecular sound velocity, especially in case of the mixtures consisting of two component liquids of widely different densities.

534.22

10706. ULTRASONIC STUDIES IN SOME ORGANIC LIQUID MIXTURES. K.Subba Rao and B.Ramachandra Rao.
J. sci. industr. Res., Vol. 18B, No. 6, 223-6 (June, 1959).

Ultrasonic velocities have been measured in a few organic liquid mixtures using a variable frequency fixed path interferometer method. A pronounced non-linear variation of ultrasonic velocity and adiabatic compressibility with concentration has been observed in some mixtures, and an attempt is made to explain these anomalou variations in terms of molecular interaction. For all the liquid mixtures studied, however, molar sound velocity and molar compre sibility have been found to vary linearly with molar concentration.

534.22 : 532.7

10707. ULTRASONIC STUDIES IN LIQUID MIXTURES. B.Krishnamurty.
J. sci. industr. Res., Vol. 17B, No. 10, 397-9 (Oct., 1958).

Adiabatic compressibilities have been calculated for 12 liquid mixtures by determing the ultrasonic velocities in them at different proportions of the component liquids in each mixture. Of these mixtures, nine have been investigated for the first time. The abnormal behaviour of some of the mixtures with respect to ultrasonic velocit and adiabatic compressibility, viz. exhibiting a maximum or a mini mum at certain proportions of one of the component liquids, has bee explained in terms of hydrogen bond formation or dipole association The results obtained for some of the mixtures in this investigation have been compared with those obtained by Raman effect, infrared absorption and other studies of the mixtures.

534.22 : 536.4

INVESTIGATION OF THE CRITICAL STATE BY ULTRASONIC
See Abstr. 9557

534.22 : 538.

DEPENDENCE OF SOUND VELOCITY AND ATTENUATION ON MAGNETIZATION DIRECTION IN NICKEL AT HIGH FIELDS.
See Abstr. 9785

534.22

10708. SPEED OF SOUND IN DISTILLED WATER AS A FUNCTIO OF TEMPERATURE AND PRESSURE. W.Wilson.
J. Acoust. Soc. Amer., Vol. 31, No. 8, 1067-72 (Aug., 1959).

An ultrasonic pulse type apparatus was used to measure the speed of sound in distilled water over the pressure range 14.7 to 14 000 lb/in^2 and the temperature range 0.9 to 91.2°C. The temperature where the maximum sound speed occurs shifts to a higher temperature when the pressure is increased. At atmospheric pressure the computed maximum speed was 1555.36 m/sec and occurred at a temperature of 74.164°C. The isotherms of sound speed, plotted as a function of pressure, are concave upward below 20°C, concave downward above 20°C, and are approximately linear near 20°C for the pressure range of 14.7 to 14 000 lb/in^2. These

curvatures have a maximum value of 1 part in 300 compared to the estimated accuracy of measurement which is 1 part in 10 000. The results are presented in tables and also in the form of a fourth degree equation fitted to the experimental data by the method of least squares.

534.221 : 537.312.62

10709. CHANGE IN VELOCITY OF SOUND BETWEEN NORMAL AND SUPERCONDUCTING STATES IN TIN.
D.F.Gibbons and C.A.Renton.
Phys. Rev., Vol. 114, No. 5, 1257-61 (June 1, 1959).

The difference in the velocity of sound between the normal and superconducting state in tin was measured at 80 kc/s. A maximum change of ~ 2 parts in 10^6 is found for a longitudinal wave in the [001] direction. Any change in velocity is < 2 parts in 10^7 for a longitudinal wave along the [100] direction or a torsional wave along the [001] direction. This disagrees with some previous determinations, but is in accord with other thermodynamic measurements. The effect of strain amplitude and magnetic field on the velocity and attenuation of the sound wave in the normal state has also been investigated in some detail.

534.222.2

10710. THEORY OF RADIATION FROM LUMINOUS SHOCK WAVES IN NITROGEN. P.Hammerling, J.D.Teare and B.Kivel.
Phys. of Fluids, Vol. 2, No. 4, 422-6 (July-Aug., 1959).

The physical properties behind a normal shock in nitrogen are calculated as a function of time. These include the variation of temperature, composition, ionization, and the intensity of radiation from the N_2^+ first negative band system. This calculation incorporates a rate equation for the dissociation of nitrogen, the conservation laws, an equation describing vibrational relaxation, and a method of coupling the vibrational relaxation with the dissociation rate. The N_2^+ radiation is computed assuming excitation of the radiating state by collision with vibrationally excited nitrogen molecules. A particular case is considered for which experimental data are available, and regions sensitive to particular rates are indicated.

534.222.2

10711. PECULIARITY OF SHOCK IMPINGEMENT ON AREA CONVERGENCE. A.K.Oppenheim, P.A.Urtiew and R.A.Stern.
Phys. of Fluids, Vol. 2, No. 4, 427-31 (July-Aug., 1959).

General study of wave systems which can result from the interaction of plane shock with an area convergence has led to the discovery of an interesting regime, specified in terms of functional relationships between shock Mach numbers and area ratios, where two or three solutions exist at the same time, all satisfying the dynamic boundary conditions imposed by the conservation laws. The ambiguity is resolved by invoking the extremum principle of irreversible thermodynamics.

534.222.2 : 535.333

10712. SHOCK-HEATED AIR. RADIATION INTENSITIES IN RANGE 0.2-1μ. See Abstr. 9405

534.23 : 539.21

10712. ULTRASONIC METHODS AND RADIATION EFFECTS IN SOLIDS. R.Truell.
J. appl. Phys., Vol. 30, No. 8, 1275-8 (Aug., 1959).

The various mechanisms producing damping of ultrasonic elastic waves in solids are reviewed in this paper. Particular attention is given to the changes in attenuation produced by pinning of dislocation lines. Measurements of ultrasonic attenuation in irradiated single crystals of NaCl are presented and discussed, on the assumption that the dislocation density remains constant while the radiation displaced defects pin the dislocations. The effects on the velocity of propagation are discussed on the basis of the same model.

534.23

10713. RESONANCE ABSORPTION AND MOLECULAR CRYSTALS. II. BENZENE. L.Liebermann.
J. Acoust. Soc. Amer., Vol. 31, No. 8, 1073-5 (Aug., 1959).

For Pt I see Abstr. 5455 (1959). Thermal oscillations in molecular solids are of two distinct classes: lattice vibrations and atomic vibrations within each molecule. These two vibrational modes can overlap in frequency and "resonate". This resonance leads to lengthy relaxation times manifested as unusually high acoustic absorption, a phenomenon termed resonance absorption. In order to study resonance absorption in solid benzene a method was developed for growing single benzene crystals of average linear dimension, 10 cm. At the acoustical frequency 10 Mc/s, absorption in single benzene crystals is found to be 0.24 cm^{-1}; at 6.4 Mc/s the value is 0.09 cm^{-1}. This excessively high absorption (10^4 higher than in crystalline quartz) was quantatively predicted from available molecular constants by a theory given previously. A partial list of compounds is given in which resonance absorption is predicted to be the dominant absorption mechanism.

534.23

10714. EXCESS ULTRASONIC ABSORPTION IN DIETHYLAMINE–WATER MIXTURES. R.N.Barfield and W.G.Schneider.
J. chem. Phys., Vol. 31, No. 2, 488-94 (Aug., 1959).

The ultrasonic absorption and velocity as well as the density and shear viscosity of mixtures of diethylamine and water have been measured as a function of composition and temperature. The absorption, which is strongly temperature dependent, reaches a large peak value at a composition of approximately 10 mole % diethylamine. Less pronounced maxima are observed in the sound velocity and shear viscosity. The system exhibits a pronounced volume contraction on mixing with evolution of heat. The origin of the large "excess" sound absorption can be accounted for in terms of a compressional relaxation and a simple molecular model based on the properties of the hydrogen bonds between like and unlike molecules in the binary solution. During compression an excess number of AB bonds are formed at the expense of AA and BB bonds leading to a relaxation process. The calculated absorption curves satisfactorily reproduce the main features of the experimental curves and yield approximate values of the mean relaxation frequency.

534.23

10715. ATTENUATION OF HYPERSONIC WAVES IN QUARTZ. H.E.Bömmel and K.Dransfeld.
Phys. Rev. Letters, Vol. 2, No. 7, 298-9 (April 1, 1959).

A study has been made of the absorption in quartz of both longitudinal and transverse ultrasonic waves in the frequency range 1000-4000 Mc/s at temperatures between 4.2° K and room temperature. The absorption was found to be largely temperature dependent with a small temperature independent component. Below 20° K, the temperature dependent part also became small and almost frequency independent; it is suggested that measurements could there be extended to much higher frequencies. Between 25° and 60° K, the absorption increased both with temperature and frequency; above about 60° K, the absorption changed only slightly with temperature, increasing for longitudinal and decreasing for transverse as the temperature is raised for frequencies of 1430 and 1000 Mc/s; at higher frequencies, it is clearly very great and no measurements are recorded for this temperature range. No satisfactory explanation of these effects is known, but some form of interaction between sound waves and thermal phonons seems likely to be taking place.
L.Mackinnon

534.232

10716. THE RIGID CIRCULAR RING RADIATING INTO AN INFINITE WALL. D.Huszty.
Acta tech. Hungar., Vol. 25, No. 1-2, 119-57 (1959). In German.

The approximate computation of a narrow radiating ring shows considerable differences from the exact formulae, if $a = s/r > 0.1$ and $kr > 1$, where s is the width of the ring, r its outer radius, $k = 2\pi/\lambda$ (wave-number). It is found that the narrower the ring, the closer to the ring is the near-space effect. The radiation reactance is relatively large, at small a, for certain values of kr. The formulae of Stenzel, Backhaus and Rayleigh for rigid disks are obtained as limiting cases.

534.232

10717. SPLASHES AS SOURCES OF SOUND IN LIQUIDS. G.J.Franz.
J. Acoust. Soc. Amer., Vol. 31, No. 8, 1080-96 (Aug., 1959).

The mechanisms of sound production by the splashes made by the gas-to-liquid entry of objects are discussed. The sound from the splash is considered to be associated with acoustic multipoles of all orders, the main ones being simple sources, dipoles, and quadrupoles. The orders of the multipoles that predominate during the various phases of the splash are estimated from the flow and boundary conditions. The sounds radiated into the water by the low-velocity vertical entry of single water droplets, sprays of water droplets, and various other objects, such as spheres, cones, and wedges, were measured and found to have the characteristics of acoustic dipoles. The extensive experimental data on the spectrum of the underwater sound from the splashes of droplets and sprays and the scaling laws for dipoles are used to estimate the spectrum levels of the underwater sound from splashing of rain on the surface of a sea in terms of the rate of rainfall.

534.232

10718. METHOD OF IMPROVING ACOUSTIC TRANSMISSION IN FOLDED HORNS. R.W.Carlisle.
J. Acoust. Soc. Amer., Vol. 31. No. 8, 1135-7 (Aug., 1959).

A novel principle has been developed, applicable to folded horns, for improving the acoustic transmission around bends having a radius greater than one-quarter wavelength. This consists of the use of a conoidal reflecting type surface in the outer half of the fold. It is beneficial in the frequency-spacial region between the usual horn wave expansion action and transmission by specular or optical type reflection. A practical application is described.

534.26 : 538.566 : 621.372

10719. SCATTERING OF A PLANE MONOCHROMATIC WAVE BY A SYSTEM OF STRIPS. K.Særmark.
Appl. sci. Res. B, Vol. 7, No. 6, 417-40 (1959).

The diffraction of a plane wave by a general system of strips is treated by means of separation of variables. A new addition theorem for Mathieu functions is used to satisfy the boundary conditions on the strips. Numerical calculations are performed for the case of two strips lying in the same plane, the boundary conditions being $\text{grad}_n \psi = 0$, while the angle of incidence of the plane wave is arbitrary. The transmission coefficient for a system of two slits in a plane, perfectly conducting screen is calculated for a range of values of the parameters. An approximate expression relating the transmission coefficients for the system of two slits to the transmission coefficient for a system of a single slit is given. As the distance between the two slits is increased, the transmission coefficient for the system of two slits very rapidly becomes nearly identical with the transmission coefficient for a single slit.

534.24

10720. REFLECTION AND REFRACTION OF ELASTIC WAVES AT THE INTERFACE OF TWO MOVING SEMI-INFINTE PLANE MEDIA. J.C.Samuels.
J. Acoust. Soc. Amer., Vol. 31, No. 8, 1076-9 (Aug., 1959).

The problem of the reflection and refraction of elastic waves at an interface of relative motion is solved. Total reflection of dilatational and rotational waves can occur for certain ranges of angles of incidence depending on the relative speed of the media. For very high relative speeds, resonance of the reflected and refracted waves occurs for certain angles of incidence, called angles of resonance. For the Poisson material and identical moving media, the relationship of the angle of resonance to the relative Mach number (based on the dilatational wave speed) is worked out and presented in the form of a curve.

534.321.9 : 535.42

10721. THE SENSITIVITY AND RESOLVING POWER OF ACOUSTICO-OPTICAL CONVERSION ON THE SURFACE OF A LIQUID. E.D.Pigulevskii.
Akust. Zh., Vol. 4, No. 4, 348-54 (1958). In Russian.

The conversion, in which the liquid surface is deformed by the acoustic pressure of an ultrasonic beam and the resulting surface relief is visualized optically, was first proposed by Sokolov in 1936. The optical part of the system records departure from parallelism of light rays reflected by various parts of the deformed liquid surface which is effectively an assembly of curved mirrors. The present author found that the sensitivity of conversion (defined as the smallest intensity of the acoustic field which can be detected after conversion) is determined by the radii of curvature of the liquid surface relief and not by the absolute depth of deformation. The sensitivity is inversely proportional to surface tension and density of the liquid. Above 10 Mc/s the surface tension forces predominate, while below 0.5 Mc/s the gravitational forces are decisive. The smallest distance that can be resolved acoustically in the case of a "double slit" (a pattern consisting of two parallel bands) was found to be $d = \lambda/1.65A$, where λ and A are the ultrasonic wavelength and aperture respectively, and λ, α are expressed in the same unit of length. A.Tybulewicz

534.321.9 : 532.570.8

ULTRASONIC FLOWMETER. See Abstr. 10663

534.372

10722. STEADY-STATE BEHAVIOR OF THE DYNAMIC ABSORBER. J.C.Snowdon.
J. Acoust. Soc. Amer., Vol. 31, No. 8, 1096-103 (Aug., 1959).

The resonant vibration of machinery and resiliently mounted equipment can be reduced with a dynamic absorber of suitable design The necessary analytical and graphical information for an optimum design is presented in this paper. It is assumed that the absorber mass is attached resiliently to the vibrating item with a rubberlike material, and not with a spring and dashpot in parallel as considered in the classical theory of Ormondroyd and Den Hartog [Transactions of the American Society of Mechanical Engineers, Vol. 50, 9 (1928)]. The dynamic absorber utilizing a material with a stiffness proportional to frequency and a constant damping factor can reduce the resonant vibration of machinery and equipment items considerably. Its performance is superior to that of the classical dynamic absorber

534.414

10723. THE DAMPING OF RESONATORS. M.Vlček.
Hochfrequenztech. u. ElektAkust., Vol. 67, No. 4-5, 135-9 (Jan., 1959). In German.

In building and auditoria acoustics resonance absorber elements are in common use. The design of these absorbers makes use of the theory of a damped Helmholtz resonator. The acoustic impedance of such a resonator has real and imaginary parts depending on both the "normal" impedance of the resonator itself and the wave impedance of the medium. The paper deals theoretically with this problem, obtaining a solution by means of the electro-acoustic analogy. Experimental observations are quoted in support of the theory.
A.B.Wood

534.647 : 550.341

10724. CONTRIBUTION OF THE INITIAL MOTIONS OF THE SEISMOMETER AND GALVANOMETER IN THE RESPONSE CHARACTERISTICS OF ELECTROMAGNETIC SEISMOGRAPHS. K.N.Banerjee.
J. Technol. (Calcutta), Vol. 3, No. 1, 25-32 (June, 1958).

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also the Section entitled "BIOPHYSICS. PHYSIOLOGICAL PHYSICS".

534.781 : 612.85

EFFECT OF SAMPLE DURATION ON THE ARTICULATION OF SOUNDS IN NORMAL AND CLIPPED SPEECH. See Abstr. 10470

534.843

10725. SELF STARTING ACOUSTIC OSCILLATIONS IN CLOSED SPACES. D.Barbaro.
Alta Frequenza, Vol. 27, No. 5, 472-85 (Oct., 1958). In Italian.

Describes the phenomenon known as "Larsen Effect" which consists in the self starting of acoustic oscillations in a closed space provided with a microphone and a loudspeaker of an amplifier. A differential equation is given to represent the phenomenon, at least in its essential features as recognized on the basis of a discussion. The theory in its development confirms the conditions of the starting and of the various oscillations which can be observed experimentally. A phenomenon of step-starting oscillations occurs when the reaction energy reaching the microphone is somewhat delayed. By introducing artificial and variable delays, experimental results are obtained which confirm the theory. Conclusions can be drawn from the theory, as well as from the experiments, which can help in avoiding the self-starting oscillation without lowering the sound level of the room so as to secure intelligibility.

534.845

10726. PANEL ABSORBENTS FOR LOW FREQUENCY SOUND ABSORPTION. N.K.D.Choudhury and M.V.S.S.Kanta Rao.
J. Instn Telecomm. Engrs (New Delhi), Vol. 5, No. 2, 103-8 (March, 1959).

Plywood panel absorbents have been designed and constructed for low frequency sound absorption. These have been tested in the laboratory and in the chamber. The resonant panels vibrating at low audio frequencies show effective absorption in the range 75-300 c/s. Peak absorption occurs near the resonant frequency calculated from the theory and the chamber values are in close agreement with those obtained in the laboratory.

OPTICS . SPECTRA . LUMINESCENCE

535

10727. G.HANSEN — 60 YEARS OLD. H.J.Höfert.
Optik, Vol. 16, No. 7, 385-90 (July, 1959). In German.
Reviews Hansen's contributions to the development of optics. Bibliography of 60 items, covering the period 1921-58.

535.313.6

10728. MIRROR ANASTIGMAT WITH TWO CONCENTRIC SPHERICAL SURFACES. P.Erdös.
J. Opt. Soc. Amer., Vol. 49, No. 9, 877-86 (Sept., 1959).
A two-mirror system suitable for imaging a small polychromatic light source at finite distance is described. The system consists of two-concentric spherical surfaces, convex and concave, respectively. Third-order spherical aberration, coma, and astigmatism are cancelled. Fifth-order aberrations are calculated explicitly to permit the computation of construction parameters and mounting tolerances according to the image quality required. A numerical example is given. The following theorem is proved: if two of the third-order aberrations, coma, spherical aberration, and astigmatism, of a two-mirror system with spherical surfaces vanish, so does the third. The theorem is applied to the special case of the monocentric system described, but it is proved for heterocentric systems.

535.315

10729. GENERALIZATION OF THE THEORY OF PRISM SPECTROSCOPIC INSTRUMENTS. K.D.Mielenz.
Optik, Vol. 16, No. 7, 391-400 (July, 1959). In German.
The theory of image formation is extended to the general case of an asymmetrical beam-path in the prism system.

535.317

10730. PRINCIPLES OF A THEORY OF THERMO-OPTICAL ABERRATIONS. I. THERMO-OPTICAL ABERRATIONS OF THE IMAGE POSITIONS. D.S.Volosov.
Optika i Spektrosk., Vol. 4, No. 5, 663-9 (1958). In Russian.
English summary: PB 141047T-2. obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.
A theoretical study of effects of temperature changes on optical systems. The changes are assumed to be so slow that temperature gradients are negligible. Coefficients for the changes of Gaussian image position and magnification are obtained for ordinary and for "thin" systems. W.T.Welford

535.317 : 771.534

10731. PRINCIPLES OF A THEORY OF THERMO-OPTICAL ABERRATIONS. II. THERMO-OPTICAL ABERRATION OF MAGNIFICATION. D.S.Volosov.
Optika i Spektrosk., Vol. 4, No. 6, 772-8 (June, 1958). In Russian.
English summary: PB 141047T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.
In precision photography one must consider thermo-optical aberrations, such as changes in the linear dimensions of the image in certain planes, e.g. on the surface of the photographic plate, which are caused by changes in temperature. Such an aberration is called the thermo-optical aberration of magnification or the second thermo-optical aberration. The author obtains an expression for the coefficient of the second thermo-optical aberration in a form convenient for optical calculations. The second thermo-optical aberration theory is applied to a system consisting of thin lenses. The author also deals with conditions for retention of the optical adjustment in a system in spite of changes of temperature.

535.317

10732. EFFECT OF A TEMPERATURE GRADIENT IN GLASS ON THE IMAGE PRODUCED BY AN OPTICAL SYSTEM. G.G.Slyusarev.
Optika i Spektrosk., Vol. 6, No. 2, 211-18 (Feb., 1959). In Russian.
The effect of temperature gradients on the form of lens surfaces is considered, as well as the effect of the refractive-index gradient produced by non-uniformity of temperature. The special case of symmetric distribution of the temperature gradient about the optical axis is discussed in detail. A.Tybulewicz

535.317.1 : 612.843

CONTRAST SENSITIVITY OF THE EYE AS A FACTOR IN THE EVALUATION OF OPTICAL IMAGES. See Abstr. 10452

535.317.2

10733. CONCENTRIC LENS. S.Rosin.
J. Opt. Soc. Amer., Vol. 49, No. 9, 862-4 (Sept., 1959).
The usefulness of a concentric lens in convergent space, with the centres of curvature of the surfaces coincident with the focus of the axial bundle, seems to have been generally overlooked. In this position the lens has no effect on the Gaussian optics, nor on any of the primary aberrations with the exception of the tangential field curvature. The sagittal field curvature is unaffected. The author has first used this device to effect an improvement in the performance of the Petzval projection lens. Another example is described.

535.317.3

10734. CALCULATION OF LAST RADIUS OF AN OPTICAL SYSTEM FOR THE CORRECTION OF ZONAL CHROMATIC ABERRATION. M.K.Sen Gupta.
J. sci. industr. Res., Vol. 18B, No. 6, 221-3 (June, 1959).
Usually in making this calculation the last glass thickness is ignored, and set almost arbitrarily. This makes the equations inexact and the chromatic correction imperfect. An exact equation suitable for use with desk calculating machines is derived, by which the two coloured rays can be brought to exact reunion. The method is illustrated by a numerical example.

535.317.4

10735. ASYMPTOTIC BEHAVIOUR OF THE RESPONSE FUNCTION OF AN OPTICAL SYSTEM WITH THE PRIMARY SPHERICAL ABERRATION. H.Itô.
J. Phys. Soc. Japan, Vol. 13, No. 6, 639-49 (June, 1958).
An asymptotic calculation of the response function of an optical system which has primary spherical aberration is carried out in the presence of a defect of focus. The evaluation of the integral for the response function is calculated by the aid of the approximate formulae for Fresnel's integral when the coefficient of the spherical aberration is sufficiently large compared with the wavelength of light. The response function denotes an interesting behaviour for various focal shifts even for a fixed value of the coefficient of the spherical aberration. When the shift is small, it has a strong decreasing character, and for larger values of it, the function becomes larger and finally begins to denote an oscillating property. The spatial frequency s extends from zero to 2 and the result is not valid in the neighbourhood of the end points because of the simplification used in the calculation. The result is compared with an experiment.

535.317.5

10736. APPLICATION OF THE HIGHER-ORDER ABERRATION THEORY TO CALCULATION OF OPTICAL SYSTEMS. D.Yu.Gal'pern.
Optika i Spektrosk., Vol. 3, No. 5, 514-28 (Nov., 1957). In Russian.
The higher-order aberration theory was used to find: (a) the number of lenses and non-spherical surfaces necessary (but not sufficient) for correction of all aberrations of the order $2t + 1$ and of lower orders, and (b) the effect of aberrations of the order $2t - 1$ and of lower orders on aberrations of the order $2t + 1$. The special case of the effect of third-order aberrations on fifth-order aberrations is discussed in detail. A.Tybulewicz

535.317.6

10737. TABLES FOR THE CALCULATION OF THIN CEMENTED DOUBLETS CORRECTED FOR SPHERICAL ABERRATION. II. VALUES OF ρ_1 AND ρ_3. A.Biot.
Ann. Soc. Sci. Bruxelles I, Vol. 73, No. 2, 245-52 (1959). In French.
An extension of tables given in Pt I (Abstr. 3546 of 1955) to give the initial and final curvatures for refractive indices 1.50 (0.04) 1.66 of each component and for a range of object positions. W.T.Welford

535.317.6

10738. TABLES FOR THE CALCULATION OF THIN CEMENTED DOUBLETS CORRECTED FOR SPHERICAL ABERRATION. III. VALUES OF ρ_1, ρ_2, ρ_3, ϖ_2, $A + 2$ for $n_2 = 1.70$ AND $n_1 = 1.50$ (0.04) 1.66. A.Biot.
Ann. Soc. Sci. Bruxelles I, Vol. 73, No. 2, 253-60 (1959). In French.
See preceding abstract. An extension of the tables to include a refractive index of 1.70 for one component. W.T.Welford

535.317.6 : 535.833

10739. SOME EFFECTS OF GLASS CHOICE IN TELESCOPE DOUBLETS. H.D.Korones and R.E.Hopkins.
J. Opt. Soc. Amer., Vol. 49, No. 9, 869-71 (Sept., 1959).
A series of air-spaced telescope doublets was investigated using

a least-squares programme written for an IBM 650 computer. The effects of glass choice on air space and state of correction are presented, together with some conclusions.

535.317.6

10740. SELECTION OF OPTICAL GLASSES IN TAYLOR TRIPLETS WITH RESIDUAL LONGITUDINAL CHROMATIC ABERRATION. N.v.d.W.Lessing.
J. Opt. Soc. Amer., Vol. 49, No. 9, 872-4 (Sept., 1959).

A method for the choice of glasses in Taylor triplets having a small residual of longitudinal chromatic aberration, is described. By using the conditions for total power, longitudinal chromatic aberration, Petzval sum, transverse chromatic aberration, and distribution of power between the first and third lenses, equations determining the power of the second lens in terms of the glass constants are derived. These equations form the basis of the method, by which a glass combination is obtained giving a small power for the second lens. The length of the objective and the position of the diaphragm are taken into consideration during selection.

535.317.6

10741. USE OF A DIGITAL COMPUTER FOR THE CALCULATION OF ABERRATION COEFFICIENTS. P.W.Ford.
J. Opt. Soc. Amer., Vol. 49, No. 9, 875-7 (Sept., 1959).

A scheme has been published (Abstr. 8674-5 of 1958) which enables the computation of the aberration coefficients of axially symmetrical optical systems, up to and including the seventh order, using a desk calculating machine. The present paper describes the design and performance of a programme for a particular digital computer based on this scheme.

535.317.6

10742. NOMOGRAM FOR THE DETERMINATION OF THE DESIGN ELEMENTS OF TRIPLETS. M.Malý.
Optik, Vol. 16, No. 6, 321-5 (June, 1959). In German.

The nomogram permits an easy and rapid determination of the basic design parameters (refractive power and distances), and forms the basis for determining the influence of external parameters on the third-order aberration coefficients. All the variants of a triplet are represented in two-dimensional space. This is achieved by the introduction of a simple function.

535.317.7

10743. RONCHI TEST OF FIFTH-ORDER ABERRATIONS. P.Erdös.
J. Opt. Soc. Amer., Vol. 49, No. 9, 865-8 (Sept., 1959).

The Ronchi test of focusing symmetrical optical instruments is described. The test patterns of fifth-order aberrations are evaluated and compared with those of the third order. The same types of aberration, irrespective of their order, yield the same type of pattern. It is concluded that the test is well suited to determine the general character of the error pertinent to the instrument.

535.318

10744. AN OBJECTIVE WITH A PHASE PLATE. A.I.Tudorovskiĭ.
Optika i Spektrosk., Vol. 6, No. 2, 198-210 (Feb., 1959). In Russian.

The author gives a theory of the images of a point at infinity produced by an objective with a phase plate (a circular diffraction grating) in front of it. Applications of phase plates for the correction of chromatic aberration of position in objectives are also dealt with. A.Tybulewicz

535.32 : 537.311.33

OPTICAL PROPERTIES OF TELLURIUM AND SELENIUM.
See Abstr. 9636

535.321 : 535.34

10745. INFRARED REFLECTION SPECTRA AND CALCULATION OF THE REFRACTIVE INDEX OF ORGANIC COMPOUNDS. M.Caméo-Bosco.
C.R. Acad. Sci. (Paris), Vol. 248, No. 11, 1642-4 (March 16, 1959). In French.

A new method is proposed for the determination of the refractive index of an organic compound in regions of anomalous dispersion where the application of other methods is difficult.

G.I.W.Llewelyn

535.323

10746. THE TEMPERATURE DEPENDENCE OF THE REFRACTIVE INDEX OF GERMANIUM. F.Lukeš.
Czech. J. Phys., Vol. 8, No. 2, 253-4 (1958).

Measurements were made on a 20° prism at wavelengths of 2.0, 2.26 and 2.51 microns at temperatures ranging from 116 to 440° K. The refractive index increases linearly with temperature. The results are in qualitative agreement with the theory of Antončík (Abstr. 7327 of 1956). C.Hilsum

535.323 : 535.231.4

10747. VARIATION OF THE OPTICAL PROPERTIES OF IRON AT TRANSITION TEMPERATURE. A.Kinbara.
J. Phys. Soc. Japan, Vol. 13, No. 8, 966 (Aug., 1958).

The emissivity of light from a heated iron plate was measured for both the parallel and perpendicularly polarized components. From the ratio of emissivities, the refractive index and the extinctio coefficient can be calculated. At the transition temperature (910° C) these are found to exhibit minimum values, presumably due to a decrease of the electrical conductivity at that temperature.

R.W.Fish

535.33

10748. THEORETICAL MULTIPLET STRENGTHS. F.Rohrlich.
Astrophys. J., Vol. 129, No. 2, 441-8 (March, 1959).

General formulae are derived for all multiplet strengths of astrophysical interest, covering all transitions of the types $l^n \cdot l' - l^n \cdot l''$, $l^n - l^{n-1} \cdot l'$, $l^n \cdot l' - l^{n-1} \cdot l'^2$, $l^{n_1} \cdot l'' - l^n \cdot l'^2$, and $l^{n_1} \cdot l' - l^n \cdot l'^2$. The expressions are given in terms of the fractional parentage and Racah coefficients, which are both tabulated. With their aid, all transitions between multiply occurring terms can be separated according to parent and — if necessary — grandparent terms. No normalization factors are needed. The results greatly enlarge the scope defined by the available tables of multiplet strengths and also permit the correction of some errors in some of these tables.

535.33

10749. SUM RULES FOR MULTIPLET STRENGTHS. F.Rohrlich.
Astrophys. J., Vol. 129, No. 2, 449-55 (March, 1959).

The previously derived expressions for the multiplet strengths for transitions between various configurations of astrophysical interest (see preceding abstract) permit one to obtain various sum rules in a simple way. Many of these sum rules are apparently new.

535.33.07

10750. THE SIGNAL:NOISE RATIO OF A SUGGESTED SPECTRAL ANALYZER. F D.Kahn.
Astrophys. J., Vol. 129, No. 2, 518-21 (March, 1959).

A mathematical treatment is made of Michelson's Fourier analysis visibility method for studying the structures of spectral lines. The effect of shot noise due to discrete absorption of photons is examined. Comparison is made between a scanning spectrograph and an interferometer. S.Tolansky

535.33.07

10751. THE APPLICATION OF DIGITAL COMPUTERS TO THE REDUCTION AND ANALYSIS OF HIGH-DISPERSION MOLECULAR SPECTRA. J.G.Phillips.
Astrophys. J., Vol. 130, No. 1, 308-23 (July, 1959).

Programmes have been developed for the IBM 701 digital computer for the calculation of vacuum wave numbers from line measurements and for the identification of the branches into which the lines of individual bands may be divided. Tests on representative spectra show that great savings of time and labour may be achieved, especially if the programmes are used in conjunction with digitizing equipment on the measuring machines to punch the measurements directly onto IBM cards.

535.33.07

10752. HIGH-RESOLUTION INTERFERENCE SPECTROMETERS WITH ONE AND TWO FABRY–PEROT ETALONS. H.Chantrel.
J. Rech. Cent. Nat. Rech. Sci., No. 46, 17-33 (March, 1959). In French.

An etalon is used in series with a plane grating; the spectrum is scanned by continuous change of air pressure at the etalon. Detection is by a photomultiplier (P); signal to noise ratio is increased by (1) cooling P in liquid N_2 and (2) increasing the time constant by very slow change of air pressure — the apparatus for doing this is described. A modification with two etalons in series is described, giving increased spectral range between orders. Performance is investigated theoretically. Intensities of lines may be compared to 0.2%. G.F.Lothian

535.33.07

10753. INVESTIGATION OF THE RADIAL DISTRIBUTION OF METALLIC ATOMS IN A DIRECT-CURRENT ARC FLAME.
E.I.Nikonova and V.K.Prokof'ev.
Optika i Spektrosk., Vol. 4, No. 2, 144-51 (Feb., 1958). In Russian. English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The concentration of Na was determined in various parts of an arc between carbon electrodes, the lower electrode (anode) holding NaCl either (1) in a hollow or (2) in a central "wick". Light from a krypton discharge passed through a 2-beam interferometer and a spectrograph. The carbon arc was in one interferometer beam and the anomolous dispersion in the D-line region produced a hook in the interference fringes of height proportional to the Na vapour concentration. The arc construction (1) gave a more uniform concentration of Na across a diameter and required much less NaCl; this form is recommended for spectrochemical analysis of small quantities of substances. G.F.Lothian

535.33.07 : 536.33.08

RESPONSE OF SELECTIVE PNEUMATIC DETECTOR.
See Abstr. 9551

535.331

10754. RATIO OF INTENSITIES OF SPECTRAL LINES IN CERTAIN DOUBLETS OF THE SECONDARY SERIES II AND I OF ALUMINIUM AND INDIUM ARC SPECTRA. M.D.Kunisz.
Acta phys. Polon, Vol. 17, No. 6, 455-61 (1958). In French.

Photographic measurements were made of the relative intensities of the components of certain doublets, where according to the rule of sums, the ratio should be 2. This ratio is confirmed for the Al lines 2660/2652 A, but not for 8 other doublets where ratios between 1.66 and 5.6 are found. G.F.Lothian

535.331

10755. THE SPECTRA OF Li III AND Li II. E.Freytag.
Naturwissenschaften, Vol. 46, No. 9, 314-15 (1959). In German.

Lines in the region 100-170 A were photographed with a grating. Measured wavelengths compare well with those of other workers and with calculations. G.F.Lothian

535.331

10756. ANOMALOUS CHANGES IN THE INTENSITY OF SPECTRAL LINES OF SAMARIUM IN A D.C. ARC.
R.R.Shvangiradze.
Optika i Spektrosk., Vol. 5, No. 1, 88-90 (1958). In Russian. English summary: 141047T-6, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The vapour pressure of the samarium compound formed at the arc anode is greater than that for other rare-earths, which explains why the author found that the intensity of the Sm lines relative to that of other rare-earth lines varies with the arc duration, and with the arc current. G.F.Lothian

535.331

10757. LOW EVEN CONFIGURATIONS IN THE FIRST SPECTRUM OF RUTHENIUM (Ru I). R.E.Trees.
J. Opt. Soc. Amer., Vol. 49, No. 9, 838-43 (Sept., 1959).

The theory of intermediate coupling with configuration interaction is used to calculate energy levels and g values in the $4d^65s^2$, $4d^75s$, and $4d^8$ configurations of Ru I. By using 15 parameters, the positions of 57 observed levels are calculated with a mean deviation of ± 54 cm^{-1} between theory and experiment. There are unexplained differences greater than 500 cm^{-1} for two other levels, one of which is well confirmed by experiment. Over-all agreement between observed and calculated g values is within ± 0.006. Linear relations are obtained between similarly defined electrostatic parameters in the three configurations.

535.331

10758. ISOTOPE SHIFT IN THE SPECTRUM OF W I.
J.A.Vreeland and K.Murakawa.
J. Phys. Soc. Japan, Vol. 13, No. 7, 663-6 (July, 1958).

By use of samples enriched in W^{183} and W^{180} respectively and of natural tungsten the isotope shift in the spectrum of W I was measured, and the ratio of the shift of the neighbouring even isotopes was determined. The result is

$$\Delta\nu(186 - 184) : \Delta\nu(184 - 182) : \Delta\nu(182 - 180) = 83 \pm 2 : 100 : 66 \pm 5.$$

Discrepant results of other observers are considered to be due to the neglect of the disturbing effect of the W^{183} components.

535.331

10759. THE ABSOLUTE f-VALUE OF THE Mn I LINE λ 4031.
G.D.Bell, M.H.Davis, R.B.King and P.M.Routly.
Astrophys. J., Vol. 129, No. 2, 437-40 (March, 1959).

The absolute f-value of the strongest line at λ 4031 in the resonance triplet of Mn I was measured by the atomic-beam technique used previously for the Cu I and Fe I resonance lines. The absolute f-value of λ 4031 was found to be 0.061, which agrees reasonably well with the results of other investigations.

535.332 : 539.18

PRECISE MEASUREMENT OF He^3 AND He^4 FAR U.V. SPECTRA.
See Abstr. 10156

535.333

10760. EMISSION SPECTRUM OF CALCIUM OXIDES.
B.Rosen and S.Weniger.
C.R. Acad. Sci. (Paris), Vol. 248, No. 11, 1645 (March 16, 1959). In French.

Spectra of various arcs and flames containing calcium oxide have been studied in the red. Flame bands appear to be of the fluctuation type due to transition from an unstable to a stable level. The vibrational frequency is about 640 cm^{-1}, which is similar to that found for the lower state of several systems of CaO. A.G.Gaydon

535.333

10761. THE TiO BAND 11032 A. A.V.Pettersson.
Naturwissenschaften, Vol. 46, No. 6, 200-1 (1959). In German.

The band constants are calculated from some new measurements. G.F.Lothian

535.333

10762. ACTION OF ARGON ON THE SPECTRUM OF I_2 VAPOUR.
I.Agîrbiceanu, C.Ghiță and V.Țopa.
Rev. de Physique (Bucarest), Vol. 3, No. 3-4, 195-202 (1958).

The emission spectra of I_2 (vapour pressure varying from that at room temperature to that of liquid N_2) mixed with argon (pressure 10-60 mm Hg) were photographed with a dispersion of 20-30 A/mm. Diffuse bands at 3100-3448 A in pure I_2 develop into a band system with heads very close together on addition of A; λ-values with and without A are tabulated. The band system at 5000-6700 A disappears on addition of A. Explanations of these effects are suggested. The broadening of the I_2 absorption lines on addition of air or A is measured from the narrowing of the Fabry—Perot fringes of the hyperfine components of Hg 5461 A. A gives greater broadening; this effect is to be further investigated. G.F.Lothian

535.333

10763. JAHN—TELLER EFFECT IN THE VIBRATIONAL SPECTRA OF HEXAFLUORIDES. B.Weinstock and H.H.Claassen.
J. chem. Phys., Vol. 31, No. 1, 262-3 (July, 1959).

Comparison of the spectra of eleven hexafluorides showed that OsF_6 and ReF_6 give weak or broadened bands originating from σ_2 and its binary combinations. This is explained by the fact that these were the only molecules studied which have the electronic degeneracy needed for the Jahn—Teller effect. J.Hawgood

535.333

10764. THE EMISSION SPECTRUM OF H_2^+. A.Boggess,III.
Astrophys. J., Vol. 129, No. 2, 432-6 (March, 1959).

The spectrum resulting from radiative association of the hydrogen molecular ion is computed. It is found that this mechanism produces less energy at visual wave lengths than does the negative hydrogen ion, which has a similar density dependence. Energy from molecular association is dominant in the ultraviolet at high temperatures but is still insufficient to account for any observed nebular radiation.

535.333

10765. ON THE CAUSE OF INFRARED EMISSION-BAND SHIFT IN FLAME SPECTRA. R.B.Tagirov.
Optika i Spektrosk., Vol. 6, No. 2, 137-40 (Feb., 1959). In Russian.

Paschen (1894) pointed out that in the infrared emission spectrum of a Bunsen flame the maximum of the 2349.3 cm^{-1} band of CO_2 molecules has a "red" shift compared with the absorption spectrum of atmospheric carbon dioxide. A similar "red" shift was reported by Julius (1907) for HCl in $H_2 + Cl_2$ flame spectra, for CS_2 and SO_2 bands in $CS_2 + O_2$ flame spectra, and so on. In view of contradictory explanations of this shift the mechanism of excitation of CO_2 molecules in diffusion flames of CO in oxygen and the cause of the infrared emission-band shift were studied. The author found that CO_2 molecules are excited thermally in flames of CO in O_2 or in air and that the emission maxima of some CO_2 bands exhibit

à "red" shift while other bands have a "violet" shift. These shifts are due to asymmetry of the bands, formation of edges on increase of the CO_2 concentration and due to superposition of other bands. A "violet" shift was also observed in a CO emission band; it was due to asymmetry and temperature broadening. A.Tybulewicz

535.333 : 539.19

DIRECTION OF HALOGEN SPECTROSCOPIC MOMENTS. See Abstr. 10184

535.34 : 535.417

10766. INTERFEROMETRIC SPECTROSCOPY IN THE FAR INFRARED. J.Strong and G.A.Vanasse.
J. Opt. Soc. Amer., Vol. 49, No. 9, 844-50 (Sept., 1959).

Michelson's visibility technique for obtaining spectral distributions interferometrically in the visible region is compared with the new far-infrared interferogram method. The scanning function for the lamellar-grating type interferometric modulator that is used for the far-infrared region has been derived. Its theoretical resolution limit is compared with the spectrum estimate obtained from experimental results with a microwave source. Discrepancies between the derived spectrum estimate, obtained by a finite Fourier series expansion, and the true spectrum are discussed. A simple technique, due to Rayleigh, is invoked to avoid distortion of the spectrum due to the so-called Gibbs phenomenon. A spectrum of H_2O extending from 8 to 60 cm^{-1} (λ = 1250 to 167 μ) illustrates the application of Rayleigh's method.

535.34.03

10767. AN INCANDESCENT LAMP WITH A MICA WINDOW FOR USE IN THE INFRARED SPECTRAL REGION. E.N.Maleev.
Optika i Spektrosk., Vol. 4, No. 1, 121-2 (Jan., 1958). In Russian. English summary: PB 141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington,D.C., U.S.A.

A filament lamp fitted with a 20 mm diameter mica window (30μ thick) forms a convenient infrared source for wavelengths less than 8μ. Constructional details are given. D.L.Greenaway

535.34.07

10768. SOME REMARKS ON MEASUREMENT OF SPECTRAL ABSORPTION. S.G.Grenishin and A.A.Solodovnikov.
Optika i Spektrosk., Vol. 3, No. 6, 665-8 (Dec., 1957). In Russian.

Errors in the measurement of optical absorption, due to the presence of scattered light in a spectrophotometer, are discussed. Two cases are dealt with: (1) measurement of optical densities at steep edges of absorption spectra; (2) measurement of optical densities of spectrally neutral objects (attenuators).

A.Tybulewicz

535.34.07

10769. ON THE PROBLEM OF MEASUREMENT OF HIGH OPTICAL DENSITIES. E.K.Putseiko.
Optika i Spektrosk., Vol. 3, No. 6, 668-71 (Dec., 1957). In Russian.

Summarizes the author's results on determination of optical densities above 3. It was found that the maximum optical density measurable with the Beckmann spectrophotometer, even when neutral attenuators are used, does not exceed 4. When optically dense filters are used, the uniformity of the objects studied is of great importance. Experiments showed also that for yellow samples whose long-wave length absorption edge is sufficiently steep, the Beckmann spectrophotometer can be used to determine optical densities not higher than 3 with an accuracy of ±5%. When the amount of light scattered by inhomogeneities in samples of the same thickness is different, different absorption spectra are obtained by the differential method.

A.Tybulewicz

535.34.07

10770. RELIABLE OPTICAL WINDOW FOR CELLS SUBJECTED TO WIDELY CYCLING TEMPERATURES AND PRESSURES.
W.C.Waggener and A.M.Tripp.
Rev. sci. Instrum., Vol. 30, No. 8, 677-9 (Aug., 1959).

A new type of window has been designed for use in high-temperature aqueous solution spectrophotometer cells. The assembly employs a sapphire window and a separate spring-loaded Teflon seal, which ensure a degree reliability, leak-tightness, and safety not previously obtained.

535.34.07 : 578.084

10771. HIGHLY SENSITIVE RECORDING MICROSPECTROPHOTOMETER. B.Chance, R.Perry, L.Åkerman and B.Thorell.
Rev. sci. Instrum., Vol. 30, No. 8, 735-41 (Aug., 1959).

This paper describes a sensitive, automatic recording microspectrophotometer capable of measuring the light absorption of substances present at "enzyme" concentrations in a single living cell. Modified dynode-feedback and measuring circuits have been especially adapted for measurement of small photocurrents at relatively high signal-to-noise ratios. The application of the instrument to observations of the mitochondrial aggregate (Nebenkern) of the grasshopper spermatid is discussed.

535.343

10772. PREDICTING ABSORPTION SPECTRA FOR COMPOSITE SOLUTIONS. V.W.Bolie.
J. Franklin Inst., Vol. 267, No. 2, 143-8 (Feb., 1959).

A formula for predicting the spectral transmission of a composite solution is developed from Beer's Law and is verified experimentally using mixtures of $Ni(NO_3)_3$ and $CoSO_4$ solutions in various proportions. G.I.W.Llewelyn

535.343 : 535.39

10773. NEW DATA ON REFLECTION AND ABSORPTION SPECTRA, ANOMALOUS DISPERSION AND TRANSITION PROBABILITIES OF SINGLE CRYSTALS OF RED MERCURIC IODIDE PERPENDICULAR TO THE OPTICAL AXIS. M.Sieskind, S.Nikitine and J.B.Grun.
J. Phys. Radium, Vol. 20, No. 5, 557-60 (May, 1959). In French.

Investigations of the anomalous dispersion were carried out at 293°K and 77°K. The values of the oscillator strength at these temperatures have been evaluated from the dispersion curve. The values obtained correspond probably to both exciton bands and the absorption of shorter wavelengths.

535.343 : 539.2

10774. MULTIPLET STRUCTURE OF EXCITONS IN CdS.
R.G.Wheeler.
Phys. Rev. Letters, Vol. 2, No. 11, 463-5 (June 1, 1959).

A description is given of the line absorption spectra near the absorption edge of single crystals at 4.2°K. The spectra are interpreted assuming an s-like conduction band and a p-like valence band, and deriving optical selection rules from the symmetry properties associated with these bands. B.T.M.Willis

535.343 : 537.311.33

ABSORPTION SPECTRA OF GaAs AND INTERVALENCE BAND TRANSITIONS. See Abstr. 9615

535.343

10775. ABSORPTION SPECTRA AND MAGNETIC RESONANCE SPECTRA OF ASPHALTENE. R.A.Friedel.
J. chem. Phys., Vol. 31, No. 1, 280-1 (July, 1959).

Discusses data on these spectra for the solid and in solution, comparing with similar data on coal and vitrain, and concluding that asphaltene consists of large molecules with many tetralin-type structures but few polynuclear condensed aromatics, and a few weak bonds easily broken to form free radicals. J.Hawgood

535.343 : 539.19

ABSORPTION SPECTRA OF ALCOHOLS IN VARIOUS SOLVENTS See Abstr. 10189

535.343

10776. DIFFUSE REFLECTANCE SPECTROPHOTOMETRY IN THE ULTRAVIOLET USING POWDERED SALTS.
T.R.Griffiths, K.A.K.Lott and M.R.C.Symons.
Analyt. Chem., Vol. 31, No. 8, 1338-41 (July, 1959).

The spectra of a variety of powders have been studied by diffuse reflectance methods in the 200 to 1000 mμ region. Compounds whose spectra in the solid state are known were used to check the reliability of the method and it is concluded that, with appropriate precautions, the resulting spectra are trustworthy at least down to 220 mμ. However, surface effects are of considerable importance. A variety of compounds whose spectra in the solid state have not been previously reported were studied. These included certain periodates, iodates, sulphur-oxy ions, sodium super-oxide, and ozonide.

535.343

10777. ON THE INFLUENCE OF OXYGEN GAS UPON THE OPTICAL ABSORPTION BANDS OF EVAPORATED BARIUM OXIDE FILMS IN THE ULTRAVIOLET REGION. T.Tomotika.
Mem. Coll. Sci. Univ. Kyoto A, Vol. 29, No. 1, 75-90 (Sept., 1958).

It was observed at room temperature that the threshold for absorption occurs at 320 mμ and the second rapid rise in absorption begins at about 250 mμ. Two absorption bands were observed between 320 mμ and 250 mμ: one has a maximum at about 303 mμ, the other at about 285 mμ. Tyler (Abstr. 3048 of 1950) assumed that the absorption bands in the region of 320-250 mμ are exciton bands. The effect of oxygen gas upon these bands under various heat treatments was investigated. By measuring the change of oxygen gas pressure in a definite volume, as well as the amount of BaO, it was observed that the absorption bands in the region of 320-250 mμ vanished and at the same time a reduction of oxygen gas pressure in the definite volume occurred, corresponding to the stoichiometric amount of oxygen in BaO. This seems to suggest that the 320-250 mμ absorption bands are due to the production of excitons.

535.343

10778. OPTICAL PROPERTIES OF PURE AND DOPED SiC.
J.A.Lely and F.A.Krüger.
Semiconductors and phosphors. See Abstr. 9597. pp. 514-24.

Measurements were made of the absorption spectra of pure SiC and of SiC, doped with N or Al. Hexagonal and cubic SiC have absorption edges at ~ 4000 and 4400 A respectively. Incorporation of N in hexagonal SiC introduces blue and red absorption bands, giving a green transmission colour. Incorporation of Al introduces green and red absorption bands, giving a blue transmission colour. Luminescence in pure and doped SiC is negligible at room temperature, but at −190°C practically all the crystals show blue luminescence with a peak at ~ 4800 A, due to an impurity centre. Many of the hexagonal crystals, notably those containing N, also show an orange fluorescence with maxima at 6000 and 6600 A, and some crystals show green fluorescence at ~ 5200 A. Phosphorescence takes place mainly in the orange band. In the infrared SiC shows strong absorption in bands from 6-13 μ. Analysis of the infrared reflection spectrum shows that the wave numbers of the transverse and longitudinal vibrations are 800 cm^{-1} and 975 cm^{-1} respectively.
J.B.Birks

535.343

10779. RADICAL SPECTRA AT LIQUID HELIUM TEMPERATURES. G.W.Robinson and M.McCarty, Jr.
Canad. J. Phys., Vol. 36, No. 11, 1590-1 (Nov., 1958).

The electronic absorption spectra of the NH_2, HNO, OH and NH radicals trapped in an argon matrix at 4.2°K have been investigated between 3000 and 8000 A. The spectra obtained are shown and a brief discussion of the results is given.
R.D.Hudson

535.343 : 537.311.33

OPTICAL PROPERTIES OF PbS, PbSe, PbTe AND THEIR ALLOYS. See Abstr. 9628

535.343 : 539.2

EXCITON AND PHONON EFFECTS IN THE ABSORPTION SPECTRA OF GERMANIUM AND SILICON. See Abstr. 10243

535.343

10780. ON ELECTRON SPECTRA OF AROMATIC HYDROCARBONS AND THEIR DEUTERATED DERIVATIVES AT 20°K. I.
V.L.Broude, E.A.Izrailevitch, A.L.Liberman, M.I.Onoprienko, O.S.Pakhomova, A.F.Prikhot'ko and A.I.Shatenshtein.
Optika i Spektrosk., Vol. 5, No. 2, 113-22 (1958). In Russian.
English summary: PB 141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The electronic spectra of the crystals of the non-deuterated and completely-deuterated forms of the hydrocarbons were compared. The spectral changes due to deuteration were: (a) shifts towards shorter wavelengths and decrease of molecular vibration frequencies, both due to changes in the energy states of the molecules; and (b) changes in the polarization ratios for the absorption bands and in the spacing between these bands, caused by changes in the crystal structure. The hydrocarbons studied were benzene, toluene, m-xylene, n-xylene, mesitylene, durene, hexamethylbenzene, naphthalene, phenanthrene and diphenyl. Methods used for the deuteration, and estimation of its degree, are also discussed.
J.Hawgood

535.343

10781. ROTATIONAL SPECTRUM OF H_2O IN THE LONG-WAVELENGTH INFRARED REGION 50-1500 μ (200-7 cm^{-1}).
N.G.Yaroslavskii and A.E.Stanevich.
Optika i Spektrosk., Vol. 5, No. 4, 384-92 (1958). In Russian.

The intensities were measured to within 10% using interchangeable echelette gratings. The light sources were a platinum ribbon covered with thorium oxide and heated electrically to 1530°K and a mercury lamp. One hundred and five absorption bands were recorded in the 50-1500 μ spectral region: 94 were interpreted as fundamental frequencies of the rotational spectrum and 11 as second orders of some of the fundamental frequencies. Thirty-four bands were recorded or resolved for the first time.
A.Tybulewicz

535.343

10782. INFRA-RED ABSORPTION SPECTRA OF SOLUTIONS OF ETHYLENE DICHLORIDE IN CERTAIN SOLVENTS.
M.Mazumder.
Indian J. Phys., Vol. 32, No. 10, 451-9 (Oct., 1958).

The infrared absorption spectra of pure ethylene dichloride and of its solutions in carbon tetrachloride, methyl cyclohexane and heptane of different concentrations were recorded with a Perkin-Elmer Model 21 spectrophotometer and compared with each other. The integrated intensities of the absorption peaks 1297 cm^{-1} and 1236 cm^{-1} were measured in each case and it is observed that in the case of 20% solutions in heptane and methyl cyclohexane the ratio A_{1297}/A_{1236} is less than that for the pure liquid and that the ratio diminishes by about 50% when the strength of the solution is diminished to 3%. In the case of solutions in CCl_4 the changes in the ratio are much smaller. The spectra due to a 5% solution of $C_2H_4Cl_2$ in heptane were recorded with the solution at 27° and 70°C and it was observed that the ratio is slightly smaller at higher temperature than at the room temperature. These changes in the ratio A_{1297}/A_{1236} are in complete disagreement with those expected from the energy difference of the two types of molecule in the solution calculated by previous workers. It is concluded that the results can be explained on the assumption that formation of virtual H—Cl linkages in the liquids is responsible for the origin of the gauche molecules.

535.343 : 537.312.5

10783. INFRARED ABSORPTION AND PHOTOCONDUCTIVITY IN IRRADIATED SILICON. H.Y.Fan and A.K.Ramdas.
J. appl. Phys., Vol. 30, No. 8, 1127-34 (Aug., 1959).

The absorption near the intrinsic edge is increased and drops off more gradually toward longer wavelengths. Several absorption bands are introduced by neutron irradiation with peak absorptions at 1.8, 3.3, 3.9, 5.5, and 6.0 μ, respectively. The observation of each band depends upon the position of the Fermi level. The 1.8 μ band has also been studied for deuteron irradiated and electron irradiated silicon, and the 3.3 μ band has been observed in electron irradiated samples. The absorption bands arise from electronic excitations of various types of defects and associated photoconductivity has been observed for the 3.9 μ and 5.5 μ bands. In addition absorption bands have been observed at long wavelengths: 20.5, 27.0, and 30.1 μ, which are associated with lattice vibration. The significance of these results is discussed.

535.343 : 535.337

10784. EFFECT OF PRESSURE ON THE ABSORPTION EDGES OF CERTAIN ELEMENTS.
H.L.Suchan, S.Wiederhorn and H.G.Drickamer.
J. chem. Phys., Vol. 31, No. 2, 355-7 (Aug., 1959).

Selenium, arsenic, white phosphorus, red phosphorus, and iodine were studied. In all cases a red shift of the edge (decrease of the energy gap) occurs with increasing pressure. White phosphorus undergoes a transition to the conducting black phase near 30 000 atm. The change in the gap with pressure for selenium is correctly predicted from conductivity measurements. An extrapolation of the gap to zero indicates that the gaps of these elements will have disappeared below 300 000 atm. This compares with previous work on sulphur where the estimated pressure for zero gap is 400 000 atm.

535.343 : 535.37

10785. ABSORPTION AND LUMINESCENCE SPECTRA OF THE Ce^{+++} IONS. P.P.Feofilov.
Optika i Spektrosk., Vol. 6, No. 2, 234-6 (Feb., 1959). In Russian.

The infrared and ultraviolet absorption spectra of monocrystals of fluorite (CaF_2) with 10^{-4}-10^{-2} g/g of Ce were obtained. The CaF_2:Ce monocrystals exhibited also intense ultraviolet luminescence.

In the infrared an absorption band was observed at 3-6 μ. This band had a structure which differed from sample to sample and these differences were due to variations in the crystal structure around Ce ions produced by various methods of preparation. The peak of the observed band was at 4-5 μ and it was due to forbidden transitions $^2F_{5/2}$-$^2F_{7/2}$ of the 4f-electron in Ce^{+++}. The ultraviolet absorption was characteristic of Ce^{+++} ions and was due to allowed 4f-5d transitions. Variations were again observed from sample to sample; as before, these variations were ascribed to differences in the structure in the immediate vicinity of the Ce^{+++} ions. The ultraviolet luminescence spectrum was also due to allowed d-f transitions. A.Tybulewicz

535.343

10786. LOW-TEMPERATURE INFRARED ABSORPTION SPECTRA OF CRYSTALLINE DEUTERATED ROCHELLE SALT IN THE 7500-5300 cm^{-1} REGION. M.P.Bernard.
C.R. Acad. Sci. (Paris), Vol. 248, No. 8, 1153-5 (Feb. 23, 1959). In French.

Spectra have been obtained, using polarized radiation, of a single crystal of 96% deuterated Rochelle salt in three orientations. The positions of the observed bands and their relative strengths are tabulated, and anharmonicity in the frequencies of the (OH) and (OD) groups is discussed. The conclusions reached fully confirm previous work by the author using non-deuterated Rochelle salt (Abstr. 4318 of 1956). D.L.Greenaway

535.343

10787. PRECISE MEASUREMENT OF FREQUENCY SHIFT OF AMMONIA INVERSION SPECTRUM. M.Yamano.
Mem. Coll. Sci. Univ. Kyoto A, Vol. 29, No. 1, 57-66 (Sept., 1958).

The shift of the centre frequency (J = K = 3) was accurately measured for pure ammonia and for mixtures of ammonia with seven other gases. The ratio of frequency shift to $\Delta\nu_p$ (pressure broadening) was determined to be $(2.8 \pm 0.1) \times 10^{-2}$, the ratio of frequency shift to gas pressure (0.77 ± 0.02) Mc/s per mm Hg, and the collision broadening parameter (27.5 ± 0.1) Mc/s per mm Hg, when the ammonia purity is about 94% and the half-half width, $\Delta\nu$ = 350 kc/s.

535.343

10788. CENTER FREQUENCY OF AMMONIA INVERSION SPECTRUM IN LOW PRESSURE REGION. M.Yamano.
Mem. Coll. Sci. Univ. Kyoto A, Vol. 29, No. 1, 67-74 (Sept., 1958).

The centre frequency of ammonia inversion spectrum (J = K = 3) was measured using a Stark modulation clock of the absorption type with reference to Tokyo UT2. The measured value of the centre frequency was corrected using the data of the preceding abstract. The Stark coefficient was also determined to be 23.52 ± 0.04 cycles per $(V/cm)^2$. The error due to the Doppler shift in the frequency measurement was minimized by using 5 Mc/s JJY and by a long time comparison of the JJY signal with a 100 kc/s crystal oscillator. The centre frequency of the spectrum was determined, from a long time comparison with the astronomical frequency standard (JJY) from February to October 1957, to be

$$23\,870\,130.05 \pm 0.05^* \pm 0.1^{**} \pm 0.2^{***} (\pm 1.2) \text{ kc/s}$$

reduced to zero pressure on UT2 with ammonia of purity of 94%, where the asterisks refer, respectively, to the errors of the atomic clock, of the reference (UT2), and due to the Doppler effect of JJY at 5 Mc/s (or 10 Mc/s).

535.343

10789. ON THE ABSORPTION SPECTRA OF COMPLEX IONS. IV. THE EFFECT OF THE SPIN—ORBIT INTERACTION AND THE FIELD OF LOWER SYMMETRY ON d ELECTRONS IN CUBIC FIELD. Y.Tanabe and H.Kamimura.
J. Phys. Soc. Japan, Vol. 13, No. 4, 394-411 (April, 1958).

It is shown that the matrix elements of the crystalline field of lower symmetry than cubic and of the spin—orbit interaction for d-electrons in octahedral complex ions can be easily evaluated by the method of tensor operators, and the tables necessary to evaluate these elements by this method are given. It is also pointed out that the effective Hamiltonian which plays the same role as the spin Hamiltonian for the non-degenerate states can be constructed for the degenerate orbital states and will be useful for the analysis of line spectra of these complexes. See also Abstr. 8668 (1956).

535.343 : 535.337 : 539.18

MICROWAVE ZEEMAN SPECTRUM OF ATOMIC OXYGEN.
See Abstr. 10159

535.343.9 : 535.375.5

10790. RAMAN SPECTRUM INVESTIGATIONS OF ASSOCIATION IN THIOACETIC ACID. G.M.Schwab and K.Lorenzen.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 36-8 (1959). In German.

Two Raman lines occur in the region of the C=O vibration. In mixtures with cyclohexanol, these are broadened into a band, suggesting association between the two by hydrogen bonding. This is discussed by comparison with acetic acid. G.F.Lothian

535.343.9 : 535.375.55

10791. STUDY BY PHOTOELECTRIC RECORDING OF RAMAN SCATTERING LINES OF LIQUIDS. R.Dupeyrat.
Ann. Phys. (Paris), Ser. 13, Vol. 3, No. 5-6, 377-423 (May-June, 1958). In French.

Details of the interferometer and light source used are described and the effects of various experimental conditions discussed. Results obtained on $GeCl_4$, $SnCl_4$, $SiCl_4$ and CCl_4 are given graphically and interpreted in detail. G.I.W.Llewelyn

535.343.9 : 535.375.54 : 535.56

10792. THEORY OF THE INFLUENCE OF OPTICAL ACTIVITY ON RAMAN EFFECT IN CRYSTALS. V.Chandrasekharan.
Z. Phys., Vol. 154, No. 1, 43-50 (1959).

The theory of the "banding" of Raman lines observed in optically active crystals is fully worked for the different classes of Raman lines. In the case of cubic crystals the Raman lines belonging to E and F classes can exhibit "normal" "reverse" or any intermediate type of banding depending on the crystal orientation, and further the perfection of the banding can vary for E lines. The crystal axes and the sign of optical activity of a cubic crystal can be deduced from Raman effect studies.

535.343.9 : 535.375.5

10793. SIMPLE CRYSTAL POWDER SOURCE FOR RAMAN SPECTROSCOPY. M.C.Tobin.
J. Opt. Soc. Amer., Vol. 49, No. 9, 850-5 (Sept., 1959).

The design features desirable in a Raman source for the study of crystalline powders are analysed. The analysis shows that the best simple source is a helical arc equipped with suitable chemical filters. The Raman tube should be in the shape of a cone fitted to the spectrograph aperture. The Rayleigh line is to be suppressed with a band-stop filter based on multilayer interference filters used in reflection. A source based on these principles was designed, constructed, and tested with a variety of crystalline powders. Results were good except for very fine powders which yielded poor spectra. Exposure times were 1-6 hr. Fluorescent and coloured samples are still beyond the reach of this source. For such samples, the use of a yellow exciting line with suitable filters is recommended.

535.343.9 : 535.375.5

10794. INTENSITY STUDIES IN RAMAN EFFECT. I. RELATIVE INTENSITIES OF RAMAN LINES IN LIQUIDS.
K.Venkateswarlu and G.Thyagarajan.
Z. Phys., Vol. 154, No. 1, 70-80 (1959).

The dependence of the relative intensities of Raman lines, having different polarization characters, on the mode of excitation was studied using unpolarized, horizontally and vertically polarized incident light. Standard intensities were obtained in the cases of CCl_4, $CHCl_3$, C_6H_6, C_2Cl_4, $C_2H_2Cl_2$, $C_2H_4Cl_2$, C_6H_5Cl, $C_6H_5CH_3$ and $C_6H_5CH_2OH$ with the intensity of the 458 cm^{-1} line of CCl_4 as standard and from these, the values of α', the derived polarizability, were obtained in the case of total symmetric lines characteristic of particular bonds. Certain conclusions regarding the intensity variations of corresponding lines in the different liquids have been deduced. Values of derived anistropy have also been obtained in the case of the depolarized lines relative to that of 313 cm^{-1} line in CCl_4.

535.343.9 : 535.375.5

10795. INTENSITY STUDIES IN RAMAN EFFECT. II. ON THE WING ACCOMPANYING THE RAYLEIGH LINE IN LIQUIDS AND LIQUID MIXTURES. K.Venkateswarlu and G.Thyagarajan.
Z. Phys., Vol. 154, No. 1, 81-9 (1959).

The distribution of intensity in the wing accompanying the Rayleigh line in CS_2, C_6H_6 and $CHCl_3$ was studied for two different modes of illumination of the Raman tube and using unpolarized and linearly polarized incident light. Investigation of the wing in the case of six binary mixtures has also been made and the results show deviation of intensity from proportionality to concentration in some cases. In all the cases studied, the position of maximum intensity

n the wing is shifted to 4 to 6 cm^{-1} from the centre of the Rayleigh ine. Further, a line at 73 cm^{-1} has been recorded in all the cases nd it has been concluded that this line has no relationship to the ature of the wing.

535.345 : 539.2

10796. OPTICAL ABSORPTION AND ENERGY LEVELS IN THE OXIDE OF VITREOUS GERMANIUM. V.G.Canina.
C.R. Acad. Sci. (Paris), Vol. 248, No. 10, 1488-91 (March 9, 1959). n French.

An energy level scheme is presented to account for the optical bsorption between 2000 A and 2800 A. The scheme adopts the un- sual concept of a conduction band applied to a vitreous solid.
B.T.M.Willis

535.345

10797. INFRARED TRANSMITTANCE AT HIGH TEMPERATURE USING A DOUBLE-BEAM SPECTROPHOTOMETER.
C.J.Parker and M.E.Nordberg, Jr.
J. Opt. Soc. Amer., Vol. 49, No. 9, 856-9 (Sept., 1959).

A furnace attachment was designed for the Perkin–Elmer Model 21 infrared spectrophotometer to investigate the effects of high emperature on the transmittance of infrared transmitting glasses nd other optical materials. The problem of interfering radiation rom the sample and furnace is resolved by taking four readings on he instrument from which the true transmittance can be computed. Results are given for a number of glasses at temperatures from 25° o 600°C. The changes in transmittance are relatively small over he range of temperatures studied. At the shorter wavelengths below μ where the absorptivity of most glasses is negligible, the change s not measurable.

535.345 : 535.37

10798. ABSORPTION OF LIGHT AND LUMINESCENCE IN MOLECULAR CRYSTALS IN THE CASE OF STRONG INTERACTION OF INTRAMOLECULAR EXCITATIONS WITH PHONONS. É.I.Rashba.
Optika i Spektrosk., Vol. 3, No. 6, 568-78 (Dec., 1957). In Russian.

Discusses band structure of the energy spectrum of excited states of molecular crystals in the case of strong interaction of ntramolecular excitations with phonons. Absorption of light and uminescence in the case of strong exciton-phonon interaction are lealt with.
A.Tybulewicz

535.345

10799. DEPENDENCE OF THE INFRARED ABSORPTION BY WATER VAPOUR ON ITS CONCENTRATION AND ON PATH LENGTH FOR THE CASE OF A SEPARATE LINE AND FOR A GROUP OF LINES IN THE 2.7 μ BAND.
K.P.Vasilevskii and B.S.Neporent.
Optika i Spektrosk., Vol. 4, No. 4, 474-80 (April, 1958). In Russian. English summary : PB141047T-9, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The single line was at 4025 cm^{-1}, the group of 9 lines at 3970-3978 cm^{-1}. Water vapour concentrations C of 1.23 to 45.5 $\times 10^{-7}$ moles/cm were used at 60° C in path lengths l of 8.8 to 160.8 m. The instrument dispersion was 2.5 cm^{-1}/mm. Diagrams show he dependence of A on various functions of C and l where A is the equivalent width of a line or group of lines determined by graphical ntegration of the absorption spectrum. Linear relations are seen between A and $\sqrt{Cl}$, but also between A/C and $\sqrt{l}$, with divergences t low and high concentrations. At high concentrations A is proporti- onal to log Cl.
S.T.Henderson

535.345

10800. SIMULTANEOUS ABSORPTION OF LIGHT IN BINARY MIXTURES. Ch.K.Muchtarov.
Optika i Spektrosk., Vol. 6, No. 2, 168-71 (Feb., 1959). In Russian.

"Simultaneous absorption" is used to describe appearance of nfrared absorption lines in mixtures of compressed gases or in solutions, absent in the spectra of pure components of the mixtures. Frequencies of the new absorption lines are given, within a few cm^{-1}, by $\nu = \nu^a \pm \nu^b$, where ν^a and ν^b are the corresponding vibrational frequencies of pure components. The effect is due to vibrational excitation of two interacting molecules of different types (a and b) which absorb simultaneously one quantum of frequency ν. The author derives a formula which relates the ntensity of a "simultaneous" absorption line with the intensities of he corresponding component lines (ν^a and ν^b) in the infrared and Raman spectra. For a molecule with a centre of symmetry the author obtains a simple selection rule which makes it possible to find frequencies of "simultaneous" absorption lines.
A.Tybulewicz

535.345 : 523.162

LIGHT ABSORPTION IN A MIXTURE OF NEGATIVE IONS O^-_2, H^- AND O^-. See Abstr. 10505

535.37 : 537.311.33 : 621.382 : 621.315.59

SEMICONDUCTORS AND PHOSPHORS. See Abstr. 9597

535.37

10801. VIth CONFERENCE ON LUMINESCENCE (MOLECULAR LUMINESCENCE AND LUMINESCENT ANALYSIS).
B.S.Neporent and P.P.Feofilov.
Optika i Spektrosk., Vol. 4, No. 6, 810-11 (June, 1958). In Russian. English summary: PB 141047T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A summary of the VIth Conference of Luminescence held in Leningrad on 17-22 February, 1958. It was convened by the Physical Institute imeni P.N. Lebedev of the Academy of Sciences of the U.S.S.R., the State Optical Institute imeni S.I. Vavilov and the Academy of Sciences of the Byelorussian S.S.R. 117 papers were read, 70 of these dealt with molecular luminescence and the remainder with luminescent analysis and other applications.

535.37

10802. INVESTIGATION OF ENERGY TRANSFER IN LIQUID ORGANIC SYSTEMS. H.P.Kallmann, M.Furst and F.H.Brown.
Semiconductors and phosphors. See Abstr. 9597. pp. 269-84.

Methods of distinguishing between the three modes of solvent–solute energy transfer in liquid solutions excited by ionizing radiations are discussed. Radiative transfer in these systems is found to be small, and the alternatives of distant or close collision transfer are considered. Energy transfer is compared with quenching by O_2 and CCl_4. Results, which are discussed qualitatively, are given for multi-"solvent" systems containing naphthalene. The quenching of excitation energy by CCl_4 and $CHCl_3$, and its reduction by added naphthalene have been studied for a range of solutes in xylene. The effect of naphthalene in enhancing the scintillation efficiency of solutions containing various elements in chemical combination, either as secondary solvents or as added salts, is tabulated. Some results are given on quenching of solutions by N_2, O_2 and air, and on the reduction of quenching in solvent combinations with paraffin oil.
J.B.Birks

535.37 : 537.312.5

10803. THEORY OF DYNAMIC QUENCHING OF PHOTOCONDUCTIVITY AND LUMINESCENCE. F.Matossi.
Semiconductors and phosphors. See Abstr. 9597. pp. 613-22.

A simple theoretical model is used to describe the effect of electrical fields and infrared radiation on photoconductivity and luminescence of inorganic phosphors. The dynamic quenching effects of photoconductors continuously excited to equilibrium conduction or luminescence are obtained from the particle balance between the energy levels of the model. Good qualitative agreement with the experimental behaviour of CdS is obtained by a suitable choice of parameters, in some cases involving 2 kinds of centres or traps. Formulae for computing the parameters from the dynamic quenching curves are derived.
J.B.Birks

535.37

10804. MECHANISM AND DEFECT RESPONSIBLE FOR EDGE EMISSION IN CdS. R.J.Collins.
J. appl. Phys., Vol. 30, No. 8, 1135-40 (Aug., 1959).

The nature of the green and blue emission at 78°K in CdS has been investigated. On the basis of the wavelengths of absorption and emission lines the blue component is assigned as exciton decay. Measurement of the decay of the blue luminescence, following excitation by a 10^{-8} sec pulse of 1 MeV electrons, gave an exciton lifetime $< 10^{-8}$ sec. Similar measurements have shown that the green component has a slower decay with emission occurring as long as 20 μsec after the excitation has ended. These results have been used to support the recombination of a free electron with a trapped hole as the mechanism for green edge emission. Heating in sulphur vapour quenches the green luminescence in a controllable fashion. From the infrared reflection spectra of CdS in the region 10 to 50 μ the optical phonon frequencies were determined. The value of 305 cm^{-1} for the longitudinal phonon is in good agreement with the prediction of Kröger and Meyer from edge emission measurements,

showing that the emission is coupled to the lattice through the longitudinal optical phonon. Based on an analysis of the effects on edge emission produced by heat treatment in sulphur vapour and electron irradiation with 0.20 and 1.0 MeV electrons, a sulphur vacancy is suggested as the recombination centre associated with the green edge emission.

535.37

10805. INTERMOLECULAR ENERGY TRANSFER AND CONCENTRATION DEPOLARIZATION OF FLUORESCENT LIGHT. A.Ore.
J. chem. Phys., Vol. 31, No. 2, 442-3 (Aug., 1959).

On the basis of Förster's general theory of energy transfer by resonance an expression has been derived which represents that fraction of the fluorescent light in a solution which is emitted by the same molecules that absorbed the incident photons. The formula applies up to about the critical concentration. It is founded on more complete considerations of nearest neighbours than those which lead to Förster's formula for the region of small concentrations. The relative merits of the two formulae are demonstrated by an application to the phenomenon of concentration depolarization of fluorescence.

535.37

10806. ANISOTROPY OF EDGE LUMINESCENCE IN CADMIUM SULFIDE. D.Dutton.
J. Phys. Chem. Solids, Vol. 6, No. 1, 101-2 (July, 1958).

Single crystals held at 90°K were illuminated by monochromatic polarized light incident normal to the crystal face and to the c-axis. In the polarized green emission, the component with E vector normal to the c-axis was ~ 6.3 times as intense as the parallel component, but this ratio was independent of the polarization of the exciting radiation, indicating an indirect relation between excitation and emission. The excitation spectrum shows peaks coincident with the absorption maxima. S.T.Henderson

535.37 : 539.2

10807. ON THE PROBLEM OF QUANTUM YIELD OF F-FLUORESCENCE. Yu.E.Perlin.
Optika i Spektrosk., Vol. 3, No. 4, 328-33 (Oct., 1957). In Russian.

The quantum yield of infrared fluorescence of the F-centres in alkali halides was calculated assuming a two-step radiationless transition 2p-2s-1s of an excited centre to its ground state. At low temperatures the quantum yield calculated in this way for KCl crystals was found to be within 1% of the experimental values.
A.Tybulewicz

535.37

10808. ZnS PHOSPHORS WITH P, As, Sb COACTIVATORS.
E.F.Apple.
J. Electrochem. Soc., Vol. 106, No. 3, 271-2 (March, 1959).

If P or As is incorporated in ZnS together with Cl, both the acceptor (P, As) and the donor (Cl) occupy S sites in the lattice, and yellow to orange fluorescence occurs under 3650 A. If Cu replaces Cl, the emission is blue or green with P, As and Sb, the blue band peaking at 4450 A and being much narrower than the "self-activated blue" in ZnS (peaking at 4600-4700 A). The Cu is now the acceptor, and the group V element the donor in a Zn site.
S.T.Henderson

535.37

10809. DEPENDENCE OF THE QUENCHING BY ABSORBING SUBSTANCES OF THE FLUORESCENCE OF SOLUTIONS ON THE VISCOSITY OF THE SOLVENT.
L.A.Kuznetsova and B.Ya.Sveshnikov.
Optika i Spektrosk., Vol. 4, No. 1, 55-9 (Jan., 1958). In Russian. English summary: PB 141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The authors used the method developed by Galanin and Levshin [Zh. eksper. teor. Fiz., Vol. 21, 121 (1951)] and some of the substances used by them (e.g., 3-aminophthalimide with crystal violet or with fuchsin, and rhodamine 5G with fuchsin, the solvents being glycerol, iso-pentanol, ethanol, methanol). The effects of the change of solvent on the overlapping of the absorption spectrum of the quenching substance with the luminescence spectrum of the quenched substance, and on the duration of fluorescence in unquenched solutions were studied and determined. This made it possible to determine the effect of solvents with various viscosities on the fluorescence yield and duration: this effect was positively established. It was also found that, as could be expected, there exists a very small quenching/viscosity dependence for viscosity values > 0.05 poise, but a large one for viscosities < 0.05 poise. The results bear out the generally adopted mechanism of fluorescence quenching.
F.Lachmar

535.37 : 545.8

NATURE OF FLUORESCENCE OF URANIUM IN FUSED SODIUM FLUORIDE. See Abstr. 10354

535.3

10810. ON THE STRUCTURE OF LUMINESCENCE CENTRES IN ZINC SULPHIDE PHOSPHORS CONTAINING ACTIVATORS.
N.Riehl and H.Ortmann.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 3-14 (1959). In German.

An investigation is made of the nature of the blue and green emitting centres due to copper activation. Transition from blue to green type is observed at temperatures as low as 200°C. This is ascribed to diffusion of Cu^+ or Zn^{++} ions in the lattice. The blue emitting centre is concluded to be formed by an interstitial Cu^+ ion near to a substitutional Cu^+ ion. G.F.J.Garlick

535.3

10811. LUMINESCENCE OF THE ANHYDROUS BORATES OF ZINC. II. ACTIVATION WITH MANGANESE.
S.Terol and M.J.Otera de la Gándara.
An. Real. Soc. Espan. Fis. Quim., Vol. 55(A), No. 3-4, 117-26 (March April, 1959). In Spanish.

Only two compounds are believed to exist, cubic $4ZnO.3B_2O_3$ and non-cubic $2ZnO.B_2O_3$, though other authors have claimed the existence of other compounds. Preparations with Mn activator were fused above 1000°C and devitrified at 850°C. The cubic form had a cathodoluminescence emission peak at 5420 A and contained divalent Mn, whereas without Mn the peak was near 4300 A. The non-cubic form, which contained some glassy material, had a peak at 4100 A (no Mn), or at 6000 A (with Mn, which in this case had an average valency > 2). Heating in H_2, or long heating in air, effected a partial change from non-cubic to cubic. Data are given for phosphorescence decay after excitation by 2537 A, and for thermoluminescence of the four materials. S.T.Henderson

535.3

10812. ON THE EFFECT OF CONCENTRATION ON THE POLARIZATION OF THE FLUORESCENCE OF RIGID SOLUTIONS.
A.Kawski.
Bull. Acad. Polon. Sci. Ser. math. astron. phys., Vol. 6, No. 8, 533-9 (1958).

The degree of polarization of the fluorescence of anthracene in a rigid polymethylmethacrylate solution is observed to decrease with increasing concentration, in accordance with Jablonski's theory. No such decrease is observed for similar solution of fluorescein.
J.B.Birk

535.3

10813. THE INFLUENCE OF TORSIONAL VIBRATIONS OF LUMINESCENT MOLECULES ON THE FUNDAMENTAL POLARIZATION OF FLUORESCENCE. J.Grzywacz.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 6, No. 11, 705-12 (1958).

The degree of polarization of fluorescence of rigid solutions of anthracene in polymethylmethacrylate is observed as a function of concentration at temperatures of 295°K and 125°K. The measurements are extrapolated to zero concentration to give the "pseudo-fundamental" polarization, which increases with decreasing temperature. The results are consistent with Jablonski's theory, which attributes the effect to the influence of molecular torsional vibrations. J.B.Birk

535.3

10814. ON THE TEMPERATURE DEPENDENCE OF THE FUNDAMENTAL POLARIZATION. C.Bojarski.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 6, No. 11, 713-17 (1958).

See preceding abstract. Jablonski's theory of the effect is expressed in a more general form, and the behaviour of benzene in glycerol is predicted. J.B.Birk

535.3

10815. MIGRATION AND TRANSFER OF ENERGY OF AN ELECTRON-EXCITATION IN ANTHRACENE AND NAPHTHALENE CRYSTALS. I.Ya.Kucherov and A.N.Faidysh.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 1, 29-35 (1958). In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

The introduction of anthracene in naphthalene crystals and

naphthacene in anthracene, caused a decrease in the luminescence quantum yield. Energy is transferred to the impurity by an exciton mechanism. This transfer becomes less efficient as the thickness of the matrix is reduced below 200 μ. J.Franks

535.37

10816. STUDY AND SEPARATION OF THE DIFFERENT MODES OF TRANSFER AND DISSIPATION OF THE EXCITATION ENERGY OF COMPLEX MOLECULES IN SOLUTION.
V.L.Levchine and E.G.Baranova.
J. Chim. phys., Vol. 55, No. 11-12, 869-77 (Nov.-Dec., 1958). In French.

The concentration quenching of luminescent solutions can occur by three processes; (i) energy transfer from monomer to monomer molecules; (ii) energy transfer from monomer to non-luminescent associated molecules; (iii) passive absorption by non-luminescent molecules. The characteristics of these different quenching processes are discussed, and methods of separating them are described, involving studies of absorption spectra, luminescence intensities under various conditions, and the influence of temperature. Results are given for solutions of rhodamine 6G and 3B in water, alcohol, glycerine and electrolytic solutions. J.B.Birks

535.37

10817. INFLUENCE OF THE CONCENTRATION OF FLUORESCENT SUBSTANCES ON THE EFFICIENCY OF FLUORESCENCE INHIBITORS. J.Lavorel.
J. Chim. phys., Vol. 55, No. 11-12, 905-10 (Nov.-Dec., 1958). In French.

When the concentration of fluorescent substances in solution is increased, an increase generally occurs in the quenching efficiency of fluorescence inhibitors. This effect, which is analogous to the phenomenon of self-quenching of fluorescence, is attributed to the migration of the electronic excitation energy by resonance transfer. J.B.Birks

535.37

10818. ON THE QUENCHING OF LUMINESCENCE OF ORGANIC SUBSTANCES EXCITED BY α-PARTICLES.
M.D.Galanin and Z.A.Chizhikova.
Optika i Spektrosk., Vol. 4, No. 2, 196-202 (Feb., 1958). In Russian. English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Fluorescent yields of stilbene, tolane, dibenzyl, naphthalene, plastic scintillators and liquids for α-particle and for γ-ray excitation are compared. The ratio of these yields is 0.1 ± 0.1 for all these materials. Carbon tetrachloride was added to terphenyl in xylol as a quenching agent. It is concluded that the low yield for α-particle excitation is due to quenching processes with a lifetime short compared with the excited state life-time of the fluorescent molecule. G.F.J.Garlick

535.37

10819. ON KINETICS OF PHOTOCHEMICAL TRANSFORMATIONS AND CONCENTRATION QUENCHING OF FLUORESCENCE OF 9-MONALKYL DERIVATIVES OF ANTHRACENE.
A.S.Cherkasov and T.M.Bember.
Optika i Spektrosk., Vol. 4, No. 2, 203-10 (Feb., 1958). In Russian. English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The effect of photo-oxidation and -dimerization on the fluorescence yield was investigated by studying concentration dependence for 9-methyl, 9-ethyl and 9-n-propyl anthracenes in ethyl alcohol. Details of experimental procedure are given. The quantum yield for the photochemical reactions increases with solute concentration. The concentration quenching of fluorescence in the three solutes is attributed to the occurrence of the photochemical reactions. G.F.J.Garlick

535.37

10820. THEORETICAL INVESTIGATION OF THE LUMINESCENCE CHARACTERISTICS OF DISPERSED LUMINESCENT SYSTEMS.
A.P.Ivanov.
Optika i Spektrosk., Vol. 4, No. 2, 225-35 (Feb., 1958). In Russian. English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Plane parallel layers of dispersed luminescent material in a surrounding medium of different refractive index were investigated. Graphs and tables for determination of the luminescence intensity from the optical constants of the layer for strongly and weakly absorbed exciting radiation are given. Conditions for optimum luminescence from such layers are determined. G.F.J.Garlick

535.37

10821. EXPERIMENTAL INVESTIGATION OF THE LUMINESCENCE CHARACTERISTICS OF DISPERSED LUMINESCENCE SYSTEMS. A.P.Ivanov.
Optika i Spektrosk., Vol. 4, No. 2, 236-44 (Feb., 1958). In Russian. English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington,D.C., U.S.A.

See preceding abstract. Experimental studies of layers of dispersed luminescent materials provide confirmation of the theoretical relations. G.F.J.Garlick

535.37

10822. DECAY OF AFTERGLOW OF ZnS:Cu PHOSPHORS IN LOG J, LOG t AND LOG J, LOG (1 + pt) COORDINATES.
F.I.Vergunas and L.R.Krasovskaya.
Optika i Spektrosk., Vol. 5, No. 2, 162-6 (1958). In Russian. English summary: PB 141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Measurements were made of the afterglow intensity J as a function of the time t and of the probability of thermal liberation of trapped electrons p. For a phosphor with one depth of trapping levels and one type of emission centres, log J should vary linearly with log (1 + pt). This was confirmed experimentally with a ZnS:Cu phosphor. J.Franks

535.37

10823. ENERGY-LEVEL POSITIONS OF SILVER LUMINESCENT CENTERS IN SULFIDES. C.C.Klick.
Phys. Rev. Letters, Vol. 2, No. 10, 418-20 (May 15, 1959).

Two alternative energy-level schemes have been proposed for monovalent activators in CdS and ZnS: type A levels just above the valence band (Schön—Klasens)and type B levels just below the conduction band (Lambe—Klick). The experimental evidence is reviewed and appears to favour type B. In an experimental test CdS:Ag at 77° K was irradiated in the fundamental absorption band with 3650 A light, and subsequently illuminated with 10 000 A light in the quenching band. The 6500 A and 7200 A emission bands were observed and were found to be equally (within 10 per cent) stimulated, indicating that both originate from type B levels. It is concluded that all emitting levels in CdS:Ag and ZnS:Ag are of this type. J.B.Birks

535.37

10824. TWO-STAGE OPTICAL EXCITATION IN SULFIDE PHOSPHORS. R.E.Halsted, E.F.Apple and J.S.Prener.
Phys. Rev. Letters, Vol. 2, No. 10, 420-1 (May 15, 1959).

See previous abstract. It is observed that photons of band gap energy (edge emission) can be continuously generated in ZnS and CdS phosphor powders at 80° K by photons with less energy. Results on a CdS powder, fired in a high-pressure sulphur atmosphere, are reported, showing the production of 2.4 eV photons by photons not exceeding 1.75 eV energy. A two-stage excitation process with transitions terminating in both conduction and valence bands, and the existence of type A and B impurity levels common to both classes of transition, are inferred. J.B.Birks

535.37

10825. CONCENTRATION QUENCHING OF FLUORESCENCE IN SOLUTIONS. K.D.Chaudhuri.
Z. Phys., Vol. 154, No. 1, 34-42 (1959).

Describes the result of the measurements of the intensity and polarization of fluorescence of dyestuffs in solution and their conductivities at different concentrations. From the nature of the variation of the intensity, polarization and conductivity with concentration, it is suggested that the quenching of fluorescence of dyes in solution is due to the collision of the second kind.

535.37

10826. COLORATION AND LUMINESCENCE. VI. K.Przibram.
Z. Phys., Vol. 154, No. 1, 111-27 (1959). In German.

A review of coloration and luminescence in various crystals including rocksalt, fluorite, feldspars, calcites and kunzites from various sources. G.F.J.Garlick

535.37 : 550.93

10827. ATMOSPHERIC DUST AND FLUORESCENCE. SUPPLEMENT TO THE ARTICLE "COLORATION AND LUMINESCENCE. VI. K.Przibram.
Z. Phys., Vol. 154, No. 4, 512 (1959). In German.

The fluorescence effects previously associated with water are now ascribed to traces of organic matter adsorbed or included at some stage in geological time (see preceding abstract). G.F.J.Garlick

535.37

10828. NARROW LUMINESCENCE BANDS OF THE NaBr–CuBr PHOSPHOR. N.I.Ivanova and P.Shvist.
Optika i Spektrosk., Vol. 3, No. 4, 399-400 (Oct., 1957). In Russian.

Samples of NaBr–CuBr were prepared by heating together NaBr and 0.03-3.0 mol % of CuBr. The luminescence spectra of these samples exhibited a narrow band at 4210 A at room temperature. This band splits up into two narrow bands with maxima at 4158 and 4184 A at −180°C. At this temperature an intense yellow band is also observed in samples heated to 300°C and higher temperatures on preparation. Two bands at 4170 and 4208 A due to CuBr also appear at −180°C. It is concluded that the two doublets observed at −180°C (4158/4184 and 4170/4208 A) are due to the same centres. A.Tybulewicz

535.37

10829. ON THE NATURE OF THE FLUORESCENT EMISSION OF PURE CdS AT VERY LOW TEMPERATURE. E.Grillot.
Semiconductors and phosphors. See Abstr. 9597. pp. 561-5. In French.

Crystals of pure CdS were prepared by 6 different methods. 5 of the specimens exhibit green fluorescence at temperatures below 77°K, but the number of spectral bands at 20°K differs. Crystals prepared by sublimation show no green fluorescence at 77°K, but a blue banded fluorescence at 20°K. The green emission is attributed to lattice defects. J.B.Birks

535.37

10830. INFLUENCE OF THE CONCENTRATION ON THE ABSORPTION SPECTRUM AND THE FLUORESCENCE ACTION SPECTRUM OF ORGANIC SUBSTANCES IN SOLUTION. J.Lavorel.
J. Chim. phys., Vol. 55, No. 11-12, 905-10 (Nov.-Dec., 1958). In French.

The shape of the fluorescence excitation (action) spectrum of organic dyes in solution depends on their concentration. In particular, the well-known decrease in the fluorescence efficiency, at wavelengths above the absorption band corresponding to the first excited state, is absent in dilute solutions and it only appears when the concentration is increased. The effect is explained quantitatively by the theory of non-fluorescent dimers. Several consequences of the dimerization are considered. J.B.Birks

535.37

10831. INVESTIGATION OF LUMINESCENCE OF SODIUM FLUORIDE ACTIVATED WITH URANIUM. Z.M.Sverdlov.
Optika i Spektrosk., Vol. 3, No. 4, 356-60 (Oct., 1957). In Russian.

The luminescence and absorption of NaF:U were studied. Luminescence was found to obey a complex decay law and its spectrum altered during decay. These luminescence properties can be used for the quantitative determination of the uranium content of minerals. A.Tybulewicz

535.37 : 539.2

10832. THERMO-OPTICAL LIBERATION OF ELECTRONS FROM TRAPPING LEVELS IN ALKALI-HALIDE PHOSPHORS. F.N.Zaitov.
Optika i Spektrosk, Vol. 4, No. 1, 102-4 (Jan., 1958). In Russian. English summary : PB 141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The stimulated luminescent spectrum of X-ray coloured KCl:Ag and KCl:Ca,Tl crystals was studied. In the Ag-phosphor the stimulated spectrum was identical to the F-band absorption spectrum but extended into the Ag-band. J.E.Caffyn

535.37 : 535.343

10833. ABSORPTION AND LUMINESCENCE SPECTRA OF INDIUM-ACTIVATED ALKALI-HALIDE MONOCRYSTALS. A.A.Dunina, Z.L.Morgenshtern and L.M.Shamovskii.
Optika i Spektrosk., Vol. 4, No. 1, 105-9 (Jan., 1958). In Russian. English Summary: PB 141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The instruments used are described. The spectral distribution of the absorption, excitation and emission of In-activated chlorides, bromides and iodides of Na, K, Rb and Cs is presented in the form of graphs (KCl, RbBr and CsI for excitation only), and a table shows the maxima of absorption bands of these monocrystals. The results obtained are discussed and compared with those obtained by Forró (Abstr. 1444 of 1930) for the same phosphors activated with Tl. F.Lachman

535.37

10834. ELECTRON-CAPTURE LEVELS OF THE ACTIVATOR IN THE NaCl:Ni PHOSPHOR. I.A.Parfianovich.
Optika i Spektrosk., Vol. 6, No. 2, 189-93 (Feb., 1959). In Russian.

The paper deals with the role of the activator electron-capture levels compared with the F-levels in NaCl:Ni. The phosphors used were activated by electrothermal diffusion and irradiated with X-rays from a 50 kV tube at room temperature. By comparing the areas under the absorption bands produced by X-ray irradiation the author deduced that only 5% of the total number of electrons localized by means of X rays are captured by the activator ions. The rest are presumably captured by anion vacancies in the NaCl lattice. It is found that only a small portion of the total amount of the activator ions present in the phosphor is effective as electron acceptors. They become such acceptors under special conditions, e.g. when coupled to anion vacancies. The author reports that such behaviour is also observed when other activators are used. A.Tybulewicz

535.37 : 535.392

10835. LINEAR LUMINESCENCE AND REFLECTION SPECTRA OF COPPER IODOMERCURATE CRYSTALS AT LOW TEMPERATURES. Chzhao Guan-tszen.
Optika i Spektrosk., Vol. 6, No. 2, 181-8 (Feb., 1959). In Russian.

Luminescence and diffuse reflection spectra of copper iodomercurate (Cu_2HgI_4) crystals were studied. This compound is a double salt of HgI_2 and CuI and exists in two modifications; the author used the β-modification which is stable below 70°C and has a tetragonal lattice consisting of layers of iodine between alternate layers of Cu and Hg. Cu_2HgI_4 was prepared in the form of a red powder consisting of small crystals. The luminescence spectra were excited at 4.2°K using the 436 mμ line and the diffuse reflection spectra were obtained both at 4.2° and 77°K. The observed linear structure of the photoluminescence and diffuse reflection spectra may be due to the crystal lattice itself or due to some lattice defects. On the basis of the available data the author excludes foreign impurities from his list of factors responsible for the linear spectrum. A.Tybulewicz

535.37

10836. EFFECT OF THE NATURE OF DECAY ON THE LUMINESCENCE SPECTRA OF BORON PHOSPHORS. M.D.Khalupovskii.
Optika i Spektrosk., Vol. 3, No. 4, 385-7 (Oct., 1957). In Russian.

Boron phosphors activated with phthalic and salicylic acids, as well as with fluorescein, were studied. The boron–phthalic acid phosphorescence spectrum remained unchanged during the decay stage and the decay was strictly exponential between 395 and 494 mμ. The forms of the boron–salicylic acid and boron–fluorescein phosphorescent spectra change during decay and their decay is not exponential. A.Tybulewicz

535.37

10837. ON A THEORETICAL DERIVATION OF THE DECAY LAW OF LUMINESCENCE FOR THE CASE OF RESONANCE QUENCHING. V.V.Antonov-Romanovskii and M.D.Galanin.
Optika i Spektrosk., Vol. 3, No. 4, 389-91 (Oct., 1957).

The decay law of luminescence is re-derived for the case of concentration (or more generally resonance) quenching in solutions. This law was first reported by Förster (1949) and Galanin (1955). In the present derivation it is assumed that quenching occurs due to induction-resonance transfer of the excitation energy from the excited to the non-excited molecules. A.Tybulewicz

535.37

10838. DECAY OF AFTERGLOW OF ZnS:Cu AND ZnS:Cu,Co PHOSPHORS NEAR AND IN THE REGION OF TEMPERATURE QUENCHING. N.L. Gasting.
Optika i Spektrosk., Vol. 3, No. 6, 624-30 (Dec., 1957). In Russian.

The results obtained agree well with the Adirovich (1951) decay law, supplemented by Vergunas (1954), who took into account temperature quenching of bimolecular type. A.Tybulewicz

535.37

10839. DECAY OF PHOSPHORESCENCE OF RIGID SOLUTIONS. M.Frąckowiak.
Acta phys. Polon., Vol. 16, No. 1-2, 63-78 (1957).

An investigation was made of the decay curves of the intensity of the phosphorescence components parallel and perpendicular to the direction of vibration of the electric vector of the linearly polarized light exciting gelatin phosphors dyed either with acridine orange or with acridine yellow. The decay curves appeared to be in agreement with Jabłonski's theory (1935), a superposition of exponential functio

with a different decay constants. Different lifetimes correspond to different groups of luminescence centres with different limiting degrees of polarization. Changes of the degree of polarization of the total phosphorescence during the further stages of the decay (longer than 10^{-6} sec after the interruption of the excitation) are conditioned by the emission of light from successive groups of centres playing an essential part in the phosphorescence.

535.37

10840. ON THE DIFFUSION THEORY OF PHOSPHORESCENCE. V.V.Antonov-Romanovskii.
Optika i Spektrosk., Vol. 3, No. 6, 592-601 (Dec., 1957). In Russian.

The author has shown earlier (1942-3) that, if the mean free path of an electron in the conduction band is of the same order as the lattice constant, then the kinetics of phosphorescence decay may be described by a linear diffusion equation which takes into account attraction of electrons by ionized centres. The author applies this equation to the case of a phosphor which has electron traps of only one type (one depth), when the probability of repeated capture of electrons is much higher than the probability of their recombination, and only a small proportion of traps is filled with electrons. It is found that the rate of phosphorescence decay is determined primarily by attraction of electrons to ionized centres of emission, and not by diffusion displacement of electrons. The author also estimates the effective cross-section of recombination of thermal electrons with ionized centres. A.Tybulewicz

535.37

10841. ON LOW-TEMPERATURE ACTIVATION OF PRECIPITATED ZINC SULPHIDE BY COPPER. K.D.Kŷnev.
Optika i Spektrosk., Vol. 3, No. 6, 652-4 (Dec., 1957). In Russian.

It was found possible to prepare ZnS:Cu phosphors, with a reasonable luminescent intensity, at temperatures not exceeding 100° C. ZnS was precipitated from a 3N solution of zinc carbonate on addition of a 3N solution of sodium sulphide and on vigorous shaking. The suspension thus produced was covered with a solution of copper sulphate containing 2×10^{-4} g/ml of Cu. After a second shaking the suspension was activated by heating at 100° C for 10 min. It was found that emission of ZnS:Cu phosphors prepared at 100° C was 100 times weaker than the emission of ZnS:Cu prepared at high temperatures and ZnS:Cu activated at 100° C exhibited no afterglow. See also following abstract. A.Tybulewicz

535.37

10842. THE STRUCTURAL SENSITIVITY OF LUMINESCENCE OF THE ZnS:Cu PHOSPHOR PREPARED AT LOW TEMPERATURES. K.D.Kŷnev.
Optika i Spektrosk., Vol. 3, No. 6, 655-7 (Dec., 1957). In Russian.

Deals with the effects of variation in the chemical conditions of preparation of ZnS:Cu at 100° C on its luminescence. Preparation of the samples followed essentially the technique described in the preceding abstract. The spectral distribution and intensity of luminescence were recorded and it was found that changes in the chemical conditions of preparation produce changes in luminescent centres, which are crystalline structural defects. This affects strongly the intensity and spectral distribution of luminescence. The results obtained suggest that the Cu activator centres are localized at the phosphor surface. A.Tybulewicz

535.37

10843. THE INFLUENCE OF OXYGEN ON ZnS AND CdS PHOSPHORS. N.Riehl and R.Sizmann.
Z. Naturforsch., Vol. 14a, No. 4, 394-403 (April, 1959). In German.

The presence of oxygen in the preparation of ZnS and CdS phosphors has a marked influence on their luminescent properties. It is shown that oxygen substitutes sulphur on the sulphide crystal lattice. Interpretations are suggested for the maximum in the "glow curves" between 10° C and 50° C, and also for the nature of the colour centres in "activation-free" ZnS and CdS phosphors. R.Parker

535.37

10844. EFFICACY OF THE SCINTILLATION OF CARBO- AND HETEROCYCLIC COMPOUNDS IN PLASTICS.
N.A.Adrova, M.M.Koton, Yu.N.Panov and F.S.Florinskii.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 1, 41-3 (1958). In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

Cyclic compounds with 4-5 rings and conjugated double bonds were the most efficient luminescent activators in polystyrene. Compounds with 3 rings were less efficient. The highest efficiencies were obtained when two organic impurities were introduced as activator and co-activator. J.Franks

535.37

10845. ON THE PROCESS IN THE TRANSFER OF ENERGY IN SCINTILLATION PLASTICS. T.P.Belikova and M.D.Galanin.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 1, 48-9 (1958). In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Measurements were made of the ultraviolet excited luminescence of polystyrene activated with anthracene and with p-terphenyl. With anthracene the probabilities of energy transfer by radiation and resonance transfer are comparable, with p-terphenyl resonance transfer predominates. J.Franks

535.37

10846. AMPLITUDES OF THE IMPULSES OF PLASTIC SCINTILLATORS WITH VARIOUS ACTIVATORS.
M.N.Medvedev, E.N.Matveeva and L.Ya.Zhil'tsova.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 1, 44-7 (1958). In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

With benzoylperoxide as activator in plastic scintillators, a luminescence efficiency of about 60% of that of stilbene was obtained. With oxazole activators in polystyrene, in concentrations between 0.5 and 1%, efficiencies were obtained up to 90% of that of stilbene. J.Franks

535.37

10847. THE DEPENDENCE ON TEMPERATURE OF THE LUMINESCENCE YIELD IN PLASTIC SCINTILLATORS OF POLYSTYRENE BASE. I.M.Rozman.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 1, 50-9 (1958). In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

The variation of luminescence intensity with temperature was measured for pure and activated polystyrene irradiated with α- and β-particles and ultraviolet. The emission increases with decreasing temperature because the luminescence efficiency increases and the self-absorption decreases. In activated plastics the variation of emission with temperature depended on the mode of excitation; no such dependence was found with pure polystyrene A temporary drop in transmissivity occurred while cooled plastics were warmed through the temperature range 200-210° K. J.Franks

535.37 : 537.311.33

10848. THE LUMINESCENCE AND CONDUCTIVITY OF CdS CRYSTALS UNDER EXCITATION BY ELECTRONS OF MEDIUM ENERGY. G.Eichhoff, G.O.Müller and G.Schubert.
Naturwissenschaften, Vol. 46, No. 6, 201 (1959). In German.

CdS crystals without activator prepared from the vapour phase were irradiated by 0.6-6 keV electrons. The intense green emission at 77° K had peaks at 5130, 5210, 5300, 5390 and 5480 A, as for optical excitation. The induced conductivity, like the visible emission, was reduced with increase of the total charge delivered to the crystal, though the conductivity was 10 times as sensitive in this respect. X-rays produced the same emission, which was stable in spite of the high loading (10^4 r/min at 40 kV). S.T.Henderson

535.37

10849. LUMINESCENCE OF CRYSTAL PHOSPHORS ON EXCITATION WITH IONS.
B.M.Nosenko, N.A.Strukov and M.D.Yagudaev.
Optika i Spektrosk., Vol. 3, No. 4, 351-5 (Oct., 1957). In Russian.

The ionoluminescence was studied of willemite, ZnS:Ag, (Zn,Cd)S:Cu, $CaSO_4$:Mn, $CaMgSi_2O_6$:Ti, KI:Tl, NaI:Tl, and of $CdBr_2$, and CdI_2 activated with Mn and Pb. The phosphors were spread in the form of thin layers on an aluminium base and were excited with positive ions of alkali metals of energies of 0.5 to 6 keV. Methods are described for determining the depth of penetration of ions into crystals and the thickness of the phosphor layer removed by irradiation with ions. A.Tybulewicz

535.37

10850. THE ABSOLUTE YIELD OF LUMINESCENCE OF PLASTIC SCINTILLATORS EXCITED WITH H γ-RAYS.
E.A.Andreeshchev and I.M.Rozman.
Optika i Spektrosk., Vol. 5, No. 1, 39-43 (1958). In Russian. English summary: PB 141047T-6, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A photomultiplier arranged in a photometer sphere was used in

conjunction with various-sized plastic scintillators in the form of 5-9 mm spheres. A mean absolute luminescence energy yield of 3.8% for the Co^{60} γ-rays was obtained. G.F.J.Garlick

535.37

10851. RECENT INVESTIGATIONS ON THE ELECTROLUMINESCENCE OF GALLIUM PHOSPHIDE.
G.A.Wolff, R.A.Hebert and J.D.Broder.
Semiconductors and phosphors. See Abstr. 9597. pp. 547-51.

Deep red, orange or yellowish-green electroluminescence was observed in single crystals of GaP. The orange and red emissions extend from about 565 mμ and 680 mμ to the near infrared. The yellowish-green emission shows a band with a maximum at 590 mμ, and also the red band. The yellowish-green and red luminescence occur in Zn-doped crystals; the orange luminescence is probably due to Ga as an activator. In all cases, above a threshold value, the emission is proportioned to the a.c. or d.c. current through the crystal, the emission and a.c. current are in phase, and the emission intensity is independent of frequency. J.B.Birks

535.37

10852. THE EFFECT OF THE STORED LIGHT-SUM ON THE BRIGHTNESS OF ELECTROLUMINESCENCE OF ZnS:Cu,Al PHOSPHOR. E.E.Bukke, L.A.Vinokurov and M.V.Fok.
Optika i Spektrosk., Vol. 5, No. 2, 172-8 (1958). In Russian. English summary: PB 141047T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

At room temperature, the electroluminescence brightness of ZnS:Cu,Al phosphors increased with increasing stored light-sum (given by the intensity of light emitted momentarily under infrared illumination). The electroluminescence brightness built up over a period of 6 min after switching on; the brightness was reduced by simultaneous irradiation with infrared light and enhanced by ultraviolet light. At low temperatures an increase in the stored light-sum caused a decrease in electroluminescence brightness. The effect of trapped electrons on the scattering of free electrons and the absorption of energy at low temperatures is discussed. J.Franks

535.37

10853. ELECTROLUMINESCENT PHOSPHORS BASED ON SULPHIDES AND SELENIDES.
O.N.Kazankin, F.M.Pekerman and L.N.Petoshina.
Optika i Spektrosk., Vol. 6, No. 5, 672-7 (May, 1959). In Russian.

Electroluminescent phosphors ZnS.ZnSe:Cu were prepared in a static atmosphere of H_2S + HCl. This method made it possible to obtain phosphors with large amounts of ZnSe (up to 100%) which emitted in the region 510-630 mμ, when excited by means of a 400 V, 5 kc/s field. The emission spectrum of each phosphor was found to depend on the frequency and voltage of the applied field and on temperature. These dependences could be explained by a decrease in depth of capture levels on addition of ZnSe to ZnS.
A.Tybulewicz

535.37

10854. ELECTROLUMINESCENCE OF AlN.
G.A.Wolff, I.Adams and J.W.Mellichamp.
Phys. Rev., Vol. 114, No. 5, 1262-4 (June 1, 1959).

Electroluminescence in the visible region is observed when AlN is excited by either a.c. or d.c. The emitted spectra consist of narrow bands in the 400-500 mμ region and broad continuous bands in the 500-700 mμ region. The broad bands vary according to the activator agents. With a.c., the luminescence is in phase with the applied voltage. With d.c., light is emitted in the vicinity of the cathode and decays with time. This decay can be explained by polarization. The presence of a barrier at the cathode is indicated. Impact excitation is proposed.

535.37

10855. SPECTRAL STUDY OF THERMOLUMINESCENCE EMISSION FROM KBr AND NaBr. B.C.Dutta and A.K.Ghosh.
Indian J. Phys., Vol. 32, No. 4, 155-64 (April, 1958).

The thermoluminescence of KBr and NaBr coloured at 90° K by 10 kV electron bombardment was studied. An automatic rapid scanning quartz spectrophotometer capable of recording spectrum in 1 sec was used to record the spectral distribution in the emission. The thermoluminescence of KBr consists of four strong glow peaks at approximately 163°, 226°, 330° and 498° K. Each of the first, second and the fourth glow peaks consists of a single band with maximum at 522, 520 and 498 mμ, respectively. There are two bands in the third glow peak with maxima at 443 and 516 mμ. The thermoluminescence glow of NaBr is characterized by two strong glow peaks at about 145° and 286° K and emission band maximum at 457 and 500 mμ, respectively.

535.3

10856. ON PHOSPHORS BASED ON $CaSO_4$.
B.M.Nosenko, L.S.Revzin and V.Ya.Yaskolko.
Optika i Spektrosk., Vol. 3, No. 4, 345-50 (Oct., 1957). In Russian.

The thermoluminescent properties of $CaSO_4$:Mn are described. The phosphor was excited with electrons, X-rays, β-rays and γ-rays and the energy stored after such irradiations was re-emitted on heating. It was found that the light-sum stored was no less than that stored on photo-excitation. It is suggested that $CaSO_4$:Mn could be used in radioactive dosimetry. A.Tybulewicz

535.3

10857. INVESTIGATION OF THERMAL DE-EXCITATION OF CRYSTALLINE QUARTZ EXCITED WITH X-RAYS.
L.G.Chentsova, B.N.Grechushnikov and E.N.Batrak.
Optika i Spektrosk., Vol. 3, No. 6, 619-23 (Dec., 1957). In Russian.

The thermal de-excitation (thermoluminescence) curves of X-ray excited crystals of quartz originating from different localities were found to differ in the number, position and the relative magnitude of maxima. Further changes in the thermal de-excitation curves could be induced by the introduction of alkali ions by electrodiffusion. The data obtained indicate that the formation and properties of the capture centres responsible for thermoluminescence are strongly affected by impurity ions. A.Tybulewicz

535.37

10858. THE TRAPPING CENTERS OF ELECTRONS IN GLASS.
H.Kawamura and T.Kikuchi.
Semiconductors and phosphors. See Abstr. 9597. p. 402.

The thermoluminescence of glass (0.6 Na_2O. 2 SiO_2), irradiated with 40 keV X-rays at −150° C, was observed from −150° to +300° C. The existence of electron traps of 0.32-0.43 eV and 0.82-1.16 eV depth is deduced, which is in qualitative agreement with previous results from electrical breakdown measurements. J.B.Birk

535.3

10859. TWO LIQUID SCINTILLATORS.
R.N.Keller, J.M.Cleveland and F.Burlingame.
J. phys. Chem., Vol. 63, No. 4, 640 (April, 1959).

Methyl and ethyl anthranilate fluoresce and also scintillate in the pure liquid state. Dilution with toluene increases the scintillation efficiency to a maximum of about half that of diphenyl oxazol in toluene. S.T.Henderso

535.

10860. RELAXATION OF ELECTROLUMINESCENCE AFTER SMALL DEPARTURES FROM THE STEADY STATE.
V.V.Antonov-Romanovskii.
Optika i Spektrosk., Vol. 6, No. 2, 229-31 (Feb., 1959). In Russian.

For small initial departures of the system from its steady state the author calculated eletroluminescent relaxation curves in their most general form, i.e., not considering the nature of the electroluminescent emission mechanism. Using the data of Bukke, Vinokurov and Fok [Inzhenerno-fizicheskii zhurnal, Vol. 1, 113 (1958)], on electroluminescent relaxation in the ZnS:Cu,Cl phosphor the author calculated, using his own theoretical formulae, the value of excited-state lifetime τ. This value was found to be 7-16 sec in the presence of an electrical field, compared with $\tau \approx 0.5$ sec measured directly during relaxation (no electric field) by Bukke et al. The discrepancy may be due to an increase of the electron energies produced by the applied electric field: the effective recombination cross-section of electrons decreases strongly with their energy, and consequently the electron lifetime is lengthened by the application of an external electric field. A.Tybulewi

535.371 : 537.226

THE PHOTODIELECTRIC EFFECT IN PHOSPHORS. See Abstr. 9586

535.371 : 53

LUMINESCENCE AND DICHROISM OF F AND M CENTRES IN POTASSIUM CHLORIDE. See Abstr. 10235

535.371 : 53

ONE-DIMENSIONAL CONFIGURATION CO-ORDINATE CURV FOR LUMINESCENCE CENTERS. See Abstr. 10239

535.376

)861. ELECTROLUMINESCENCE OF INSULATED PARTICLES. .Maeda.
Phys. Soc. Japan, Vol. 13, No. 11, 1352-61 (Nov., 1958).

The origin of the local high electric field in the electrolumines-ence of insulated phosphor particles is considered and attributed to e disturbance of the applied field due to the conductive substance the insulative phosphor. The distributions of the local field are lculated and the dependence of brightness on the applied voltage discussed, However, comparison with experimental data is im-ossible because of the complicated structure of the phosphor. The minous efficiency of electroluminescent cell is estimated and greement is obtained with the observed value.

535.376 : 539.1.07

862. EFFICIENCIES AND PHOTOFRACTIONS FOR GAMMA ADIATION ON SODIUM IODIDE (THALLIUM ACTIVATED) RYSTALS. W.F.Miller, J.Reynolds and W.J.Snow.
v. sci. Instrum., Vol. 30, No. 2, 141 (Feb., 1959).

These quantities have been calculated by a Monte Carlo method r point and disk sources of 5 energies from 0.279 to 4.45 MeV, r cylindrical crystals of 6 radii from 1.0 to 16.0 in. and of 4 ights from 1.0 to 8.0 in. The results have been compiled in port ANL-5902, obtainable from Office of Technical Services, ashington 25, D.C., U.S.A. J.B.Birks

535.39 : 539.2

OPTICAL PROPERTIES OF NOBLE METALS.
e Abstr. 10266

535.39 : 539.234

INFLUENCE OF THE METHOD OF PREPARATION ON THE AVELENGTH DEPENDENCE OF THE OPTICAL CONSTANTS F THIN SILVER FILMS UNDER VACUUM. See Abstr. 10302

535.393 : 539.23

863. REFLECTION AND TRANSMISSION FACTORS AND BSORPTION COEFFICIENTS OF THIN GOLD LAYERS FOR ADIATION OF WAVELENGTHS BETWEEN 2536 A AND 6438 A. Philip.
Phys. Radium, Vol. 20, No. 5, 535-40 (May, 1959). In French.

The coefficients of layers, of thickness between 0 and 95 mμ re measured, and corresponding absorption coefficients deduced. ie measurements were made for 12 radiations of wavelengths tween 2536 and 6438 A. The variations of these coefficients as a nction of the thickness of the layers, and, for a given thickness, a function of the wavelength are investigated.

535.393

864. A NEW MODIFICATION OF THE POLARIZATION ETHOD OF MEASUREMENT OF THE OPTICAL CONSTANTS OF ETALS. I.N.Shklyarevskii and V.K.Miloslavskii.
tika i Spektrosk., Vol. 3, No. 4, 361-7 (Oct., 1957). In Russian.

The modification is for measurements in the visible and infra-d regions. The light is reflected three times from two identical rallel mirrors made of the metal studied. The angle of incidence chosen so that the initially elliptically polarized light is converted o linearly polarized light. The optical constants are deduced m the angle of incidence and the azimuth of reduced (relative) arization. The method was applied to obtain the optical constants aluminium in the visible region. A.Tybulewicz

535.393

865. MEASUREMENT OF THE OPTICAL CONSTANTS OF PPER, GOLD AND NICKEL IN THE INFRARED REGION OF THE ECTRUM. I.N.Shklyarevskii and V.G.Padalka.
tika i Spektrosk., Vol. 6, No. 1, 78-84 (Jan., 1959). In Russian.

Measurements were made in the region of 1-12 μ by the method Shklyarevskii et al. (see preceding abstract and Optika i Spektrosk., l. 4, 792, 1958). Reproducible values of the refractive index and sorption index were obtained on a number of samples. Using the ssical Drude theory of free electrons in metals the authors cal-ated densities of free electrons, relaxation times and d.c. conduct-ies of copper, gold, nickel and silver (for silver the authors used blished optical constants). From the known values of the refractive l absorption indices the authors calculated the absorption coef-ent A given by

$$A = 1 - R = 4\mu/[(\mu + 1)^2 + k^2]$$

ere R is the reflectivity, and μ and k are the refractive and sorption indices respectively. The dependence of the absorption fficient A on wavelength is given for copper, silver, gold and kel in graphical form. A.Tybulewicz

535.393

10866. EFFECT OF THE CONTACT SURFACE ON THE OPTICAL PROPERTIES OF SILVER IN THE REGION OF ITS REFLECTION MINIMUM. G.P.Skornyakov and I.I.Sasovskaya.
Optika i Spektrosk., Vol. 3, No. 4, 380-2 (Oct., 1957). In Russian.

When a freshly polished clean silver surface is placed in contact with quartz or Plexiglas the sharp reflection minimum at 3200 A is destroyed. It is suggested that these effects are due to adhesion forces at the interface of silver with the quartz or Plexiglas layer. These forces may affect the lattice field, leading to widening and approach of the 5s and the 5p bands, and perhaps even overlapping of these two bands. The effects observed are similar to those obtained on intense mechanical polishing and on heating (to about 300° C). A.Tybulewicz

535.393 : 535.87

10867. REFLECTION SPECTRA OF DIELECTRIC MIRRORS. V.V.Sukhanovskii.
Optika i Spektrosk., Vol. 3, No. 4, 382-84 (Oct., 1957). In Russian.

The paper reports experimental verification of the author's theory of multilayer dielectric mirrors (Abstr. 8130 of 1956). The theory was tested by measuring the reflection spectrum of a seven-layer mirror having alternate layers of zinc sulphide and cryolite vacuum-deposited on a glass plate. A.Tybulewicz

535.393

10868. DISPERSION OF THE PHASE-SHIFT OF THIN ALUMINIUM FILMS. I.N.Shklyarevskii and A.N.Ryaznov.
Optika i Spektrosk., Vol. 2, No. 5, 645-50 (1957). In Russian.

The phase-shift was determined from an interferometric study of an Al–ZnS–Al multilayer on glass, the outer layer being of various thicknesses. The phase shift at 5500 A altered its sign in the 50-80 A layer thickness range. The experimental results are compared with a theory based on the assumption that optical constants are independent of thickness. A plot of phase-shift against wavelength (4000-6000 A) is given. L.Bovey

535.412

10869. ON TALBOT'S BANDS. M.N.Bashkatov.
Optika i Spektrosk., Vol. 4, No. 6, 791-2 (June, 1958). In Russian.
English summary: PB 141047T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The method of obtaining interference bands in a continuous spectrum which was proposed by Talbot has a certain perculiarity. If, in observation of a continuous spectrum, one half of the ocular aperture of a spectroscope is covered by a thin transparent plate on the violet side of the spectrum, then dark interference bands are observed in the spectrum. It was reported that these bands did not appear if the ocular aperture was covered by a plate on the red side of the spectrum. The present author reports how, under certain conditions, Talbot's bands may also be obtained when a plate is introduced on the red side of the spectrum.

535.412

10870. ON A REMARK BY WOOD: THE STATICS AND DYNAMICS OF MICHELSON'S INTERFEROMETER. P.M.Duffieux.
Rev. Opt., Vol. 36, No. 8-9, 376-90 (Aug.-Sept., 1957). In French.

A discussion of comparative resolving powers for fringe separations in the two cases of (a) an ordinary doublet and (b) an artificial doublet due to Doppler effect if the path difference is increased at a high velocity. The separation of two identical frequency groups is thereby always theoretically possible. Effects of "noise" and of natural radiation width are discussed and a comparison between coherent and incoherent radiation is made. [The "remark by Wood" in the title arose in conversation with the late Ch.Fabry, and is unpublished]. S.Tolansky

535.417 : 531.715

10871. SOME REMARKS ON THE QUESTION OF APERTURE CORRECTIONS IN INTERFEROMETRIC LENGTH MEASUREMENTS. R.Landwehr.
J. Opt. Soc. Amer., Vol. 49, No. 7, 733-4 (July, 1959).

A summary of the computations made in particular in connection with the practical measurements of end standards. Some of the calculations of Bruce (Abstr. 1130 of 1956) are modified. Aperture corrections are shown graphically for the cases of (1) a circular hole (2) a narrow slit (3) a square aperture. S.Tolansky

535.417 : 545.82

10872. PHOTOELECTRIC RECORDING INTERFEROMETER FOR GAS ANALYSIS. S.Namba.
Rev. sci. Instrum., Vol. 30, No. 8, 642-5 (Aug., 1959).

The central part of the interference fringes is projected on the

single slit of a photomultiplier through a polarizer P_1 with its principal axis perpendicular to fringes and a field-splitting polarizer P_2 whose two polaroid planes are split by a line parallel to fringes and oriented to ±45° to the principal axis of the polarizer P_1 and a rotating polaroid disk. When the centre of a fringe is brought in line with the splitting line of polarizer P_2, the alternating photocurrent becomes zero. Any change of position of the centre line of the fringe relative to the splitting line generates an alternating photocurrent with an amplitude which is a function of the fringe shift and a phase which is a function of the direction of the shift. The shift of fringes which is proportional to gas concentration is detected; this shift makes a servomotor start to put the fringes back to their original position optically. The angle of rotation of the servomotor is proportional to the shift of fringes indicating the variation of the refractive index, i.e., the variation of the content ratio of the mixed gas. The sensitivity of this apparatus is observed to be about 1×10^{-8} index unit, or in the case of CO_2 gas in air, about 0.01% by volume.

535.417 : 531.715 : 621.317.39

10873. LENGTH MEASUREMENT BY FRINGE COUNTING.
K.Hara and D.S.Smith.
Rev. sci. Instrum., Vol. 30, No. 8, 707-10 (Aug., 1959).

A reversible fringe counter was constructed and its performance examined. A counting rate of 100 fringes per sec over a path difference exceeding 20 cm was obtained. The fringe excess fraction at zero path difference could be determined to 0.001 fringe, and a relative precision of about $1 : 10^6$ was achieved at a path difference of 6.4 cm.

535.42 : 534.321.9

ACOUSTICO-OPTICAL IMAGE CONVERSION. See Abstr. 10721

535.421

10874. DIFFRACTION GRATINGS FROM THE STATE OPTICAL INSTITUTE. F.M.Gerasimov, I.A.Tel'tevskii, S.S.Naumov, S.N.Spizharskii and S.V.Nesmelov.
Optika i Spektrosk., Vol. 4, No. 6, 779-90 (June, 1958). In Russian. English summary : PB 141047T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The present paper describes briefly the technique of preparation of optical diffraction gratings and discusses in detail the optical characteristics of these gratings in the ultraviolet, visible and near infrared spectral regions.

535.421

10875. USE OF ECHELETTES AT LARGE ANGLES OF DIFFRACTION. V.I.Malyshev and S.G.Rautian.
Optika i Spektrosk., Vol. 6, No. 4, 550-5 (April, 1959). In Russian.

Echelette grooves have a non-symmetrical triangular form and the main diffraction maxima produced by echelettes are strongest when specular reflection from one of the groove sides is employed. Normally the wider side of the groove is used; the corresponding blaze angle ϕ_1 varies between 10° and 25°. The present paper shows that, if the narrower side of the groove is used (with the larger blaze angle ϕ_2), the resolving power of an echelette grating used in conjunction with a monochromator can be doubled. Furthermore, the echelette can then be employed for a wider range of wavelengths. A.Tybulewicz

535.43

10876. THE CALCULATION OF THE SCATTERING OF LIGHT WITH DOUBLING OF THE FREQUENCY. T.Neugebauer.
Z. Phys., Vol. 155, No. 3, 380-6 (1959). In German.

This is an outline of second-order calculations based on the Schrödinger equation and on the Dirac equation. W.A.Hepner

535.434 : 539.19

10877. INTERPRETATION OF LIGHT SCATTERING DATA OBTAINED FROM SOLUTIONS OF LARGE ROD-LIKE PARTICLES. M.E.Reichmann.
Canad. J. Chem. Vol. 37, No. 2, 489-92 (Feb., 1959).

It is shown that number averages of molecular weights of rod-like particles evaluated from the angular distribution of the intensity of scattered light are not accurate in practice. Results obtained on tobacco mosaic virus and potato X virus are quoted. G.I.W.Llewelyn

535.434

10878. SCATTERED-LIGHT INTENSITY OF LARGE SPHERICAL PARTICLES. II. H.Walter.
Optik, Vol. 16, No. 7, 401-8 (July, 1959). In German.

For Pt I, see Abstr. 6072 (1957). The intensity was calculated in the range from 0° to 180°, with particular reference to back scattering, for particles having a refractive index of 1.33, and for value of α (particle circumference divided by the wavelength of the light) equal to 10, 15, . . . 95, 100, 110, . . . 200, 250, 300, 350, 400. The tabulated values of the intensity functions i_1 and i_2 enable the behaviour of the scattering function to be discussed over a wide range of particle radii. They provide a basis, moreover, for the theoretical discussion of the scattering phenomena in the atmosphere and in interstellar space.

535.434

10879. SCATTERED-LIGHT INTENSITY OF LARGE SPHERICAL PARTICLES. III. J.Pfleiderer.
Optik, Vol. 16, No. 7, 409-11 (July, 1959). In German.

Continuing the calculations of the preceding abstract, the intensities were calculated for values of α equal to 85, 90, 95, 100, 110, . . ., 200, 250, 300, 350, 400, and for values of the scattering angle θ (angle between the directions of propagation of scattered and unscattered light) equal to 10°, 20°, . . ., 80°, 100°, 110°, . . ., 140°.

535.435 : 532.7

LIGHT SCATTERING BY ORGANIC LIQUIDS AT TEMPERATURES NEAR THEIR FREEZING POINTS. See Abstr. 10680

535.51 : 551.46

INVESTIGATION OF OCEANS BY DEGREE OF POLARIZATION OF SCATTERED LIGHT. See Abstr. 10407

535.514.

10880. POLARIZATION OF INFRARED RADIATION BY REFLECTION FROM GERMANIUM SURFACES.
D.F.Edwards and M.J.Bruemmer.
J. Opt. Soc. Amer., Vol. 49, No. 9, 860-1 (Sept., 1959).

The percent polarization for the infrared radiation reflected from a germanium mirror has been measured to be greater than 99% from the near to far infrared wavelength regions. The intensity of the polarized beam was about 40% of that of the original unpolarized beam. The advantages of the germanium polarizer are the constant high degree of polarization over the wide wavelength region, the availability and ease of preparation of the mirror, ruggedness, and the polarizing properties which do not change with age or when exposed to intense radiation.

535.514.

10881. MEASUREMENT OF THE DEGREE OF POLARIZATION WITH THE HELP OF A COMPENSATING SET OF GLASS PLATES. III. A.Kawski.
Optik, Vol. 16, No. 7, 412-18 (July, 1959). In German.

For Pt II, see Abstr. 1346 (1959). The formulae for two, three and four glass plates, which take into account internal reflections only, are generalized to the case of absorption of light in the plates and the application of these formulae to the measurement of the degree of polarization of light waves in the photoelectric method of Tumeran–Wille–Spektorov is discussed.

535.55

10882. STRESS AND WAVELENGTH DEPENDENCE OF BIREFRI BIREFRINGENCE IN CUBIC CRYSTALS IN THE VISIBLE REGION.
K.S.Iyengar and K.G.Bansigir.
Curr. Sci., Vol. 27, No. 11, 436-7 (Nov., 1958).

The relative retardation per unit thickness for eight crystals was measured over a stress range of 0 to 50 kg cm^{-2} and a wavelength range 4800-6000 A. The crystals were potassium iodide, lithium fluoride, calcium fluoride, potassium alum, ammonium alum barium nitrate, lead nitrate and thallium alum. Graphs of retardation against stress are always linear when the stress is applied in the [001] direction and observation made along the [010] or [100] directions. The linear relationship holds also for stresses in the [111] direction with observation made in the [211] direction. The values $(q_{11}-q_{12})$, $(q_{11}-q_{13})$ and q_{44} are tabulated together with the dispersion. See also Abstr. 1002 (1958). H.G.Jerrar

535.64

10883. SIMPLE FORMULA FOR CALCULATING WHITENESS FROM PHOTOELECTRIC TRI-STIMULUS DATA. A.W.Croes.
J. Opt. Soc. Amer., Vol. 49, No. 8, 830-1 (Aug., 1959).

A very simple equation is given for the whiteness of materials with yellowish departures from neutral white. The equation is also expressed in terms of the standard CIE coordinates. Measurement on wheat samples show that the whiteness obtained agrees with those from other methods. R.W.Fis

535.653

0884. INFLUENCE OF SHADOW QUALITY ON COLOR PPEARANCE.
.M.Newshall, R.W.Burnham and R.M.Evans.
. Opt. Soc. Amer., Vol. 49, No. 9, 909-17 (Sept., 1959).

Shadows of skylight quality and of daylight quality were cast pon various test samples. The colour appearance of a test sample, oth as shadowed and as unshadowed, was matched by adjusting the eld of a visual colorimeter. Only the skylight shadow evoked any end in hue, and this was toward the blue; but both shadows prod- ced systematic losses in saturation and lightness. Still none of ese perceptual changes was as great as the corresponding colori- etric change in the test stimulus would suggest; in other words, onsiderable colour constancy was associated with both shadows. he difference in effect between the two kinds of shadows was apprec- ble as evaluated in Munsell hue but seemed almost negligible as egards value and chroma. These results refer to the attention- irected experimental observations; more casual viewing presumably ould result in more constancy effect and even less differential ffect.

535.7

PHYSIOLOGICAL OPTICS. VISION. See also the Section ntitled "BIOPHYSICS. PHYSIOLOGICAL PHYSICS".

535.81

0885. A VOCABULARY OF OPTICAL PRISMS. A.Fiorentini.
tti Fond. Ronchi, Vol. 14, No. 3, 181-218 (May-June, 1959).
n Italian.

A comprehensive account is given of optical prisms and over 0 types are named and briefly described. R.W.Fish

535.81

0886. TOLERANCES FOR ROOF PRISMS. G.R.Rosendahl.
. Opt. Soc. Amer., Vol. 49, No. 8, 830 (Aug., 1959).

The tolerances are quoted for deviation of the roof angle from 0° and for the width of the chamfer on the roof edge. The former s derived from the angular doubling and the resolving power of the ye. The latter is deduced from the loss of contrast in the image. he expressions indicate that the two tolerances behave in opposite ays if the roof prism is moved closer to the objective, the angular olerance becoming smaller, the chamfer width tolerance larger. R.W.Fish

535.81

0887. OPTICAL SINGLE CRYSTALS OF STRONTIUM AND BARIUM FLUORIDES.
.V.Stepanov, I.A.Sinyukova and É.G.Chernevskaya.
Optika i Spektrosk., Vol. 4, No. 2, 272-4 (Feb., 1958). In Russian.
English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Single crystals, 40 mm dia. and 200 g weight, were grown from melts of Sr- and Ba-chlorides and NaF or KF at high temperatures n vacuum. The refractive indices, dispersion and transmission in he ultraviolet, visible and infrared were measured and found to be imilar to those of CaF_2, with a transmission limit for SrF_2 near 800 A and for BaF_2 near 2000 A. C.Turner

535.825 : 548.5

APPARATUS FOR THE STUDY OF CRYSTAL GROWTH UNDER HE MICROSCOPE. See Abstr. 10356

535.825.3

0888. FILAMENT FURNACE FOR MICROSCOPY STUDIES AT IGH TEMPERATURES. H.W.Newkirk, Jr., and J.L.Bates.
Rev. sci. Instrum., Vol. 30, No. 8, 645-6 (Aug., 1959).

A filament furnace is described which is suitable for heating ram quantities of materials to 3000°C under reduced pressures or n various atmospheres. A quartz window and shutter assembly per- nit the observation of the specimen during the heating cycle by long vorking distance microscopes.

535.89

0889. PHYSICAL AND TECHNICAL DETAILS OF FLASH TUBES ITH SPECIAL REFERENCE TO THEIR USE IN CINEMATOGRAPHY.
H.Grabner and M.Reger.
Tech. wiss. Abhandl. Osram-Gesell., Vol. 7, 52-62 (1958). In German.

The greater part of the paper is devoted to a description of the nethod of operating flash tubes and the ways in which the charac- eristics of the flash can be controlled by suitable circuit arrange- nents. Special consideration is given to flash duration and to the uantity of light (lumens × time) emitted in a single flash. The use of the flash tube for cinema projection is discussed in detail and it is concluded that this technique, although it may have certain special applications, does not at present give promise of any practical advantages as far as ordinary cinematography is concerned. J.W.T.Walsh

535.89

10890. THE ENTROPY OF FLASH LAMPS.
H.Kocher and G.Kocher.
Tech. wiss. Abhandl. Osram-Gesell., Vol. 7, 297-305 (1958). In German.

A study was made of the entropy variation for the O_2—Al system in a flash source. The Al could only be burnt completely in the pres- ence of excess O_2. Data are given on the necessary amounts of excess O_2 for such complete combustion. J.D.Craggs

HEAT

536.08

10891. THE TEMPERATURE BALANCE, A MKSA STANDARD THERMOMETER. E.Bodea.
Acta. phys. Austriaca, Vol. 12, No. 3, 220-36 (1959). In German.

The temperature balance consists of a combination of a simple Kelvin gas thermometer and a plate balance, and serves to realize an MKSA unit of temperature in terms of the standard kilogram in the same way as the current balance does for the ampere. The author discusses how the MKSA system need not therefore be supple- mented by the degree K. A coherent system is obtained if the Ulich deka-mol (D-M = 10^{24}) is chosen for the MKS unit of quantity; $10^5 N/m^2$ for the pressure unit; and the kinetic unit, based on the equipartition of energy, joule/D-Mol, for the temperature unit. The international temperature scale is replaced by the kinetic scale which depends on only the absolute zero of temperature and the condition $\Delta Q/\Delta T$ = constant. S.Weintroub

536.2.01

10892. LAWS OF CORRESPONDING STATES FOR THE THERMAL CONDUCTIVITY OF MOLECULAR SOLIDS. R.W.Keyes.
J. chem. Phys., Vol. 31, No. 2, 452-4 (Aug., 1959).

It is found that measured thermal conductivities of solid neon, argon, and krypton obey a law of corresponding states based on molecular units. Deviations from the law due to quantum mechan- ical effects are noted, and a modified law which takes account of the quantum mechanical phenomena and is also applicable to solid parahydrogen is given. A law of corresponding states for the thermal conductivity based on the critical constants is also found to give a good representation of the data for the solidified inert gases.

536.2.02 : 538.66

10893. THE BIPOLAR RIGHI—LEDUC EFFECT. P.J.Price.
I.B.M. J. Res. Developm., Vol. 2, No. 3, 249-51 (July, 1958).

A generalization of the theory of the bipolar (or ambipolar) contribution to the thermal conductivity of semiconductors, so as to include the rotation of the energy flux vector relative to the temp- erature gradient, caused by a magnetic field (Righi—Leduc — R-L effect). In principle the study of this bipolar contribution to the R-L effect can help to decide the importance of the bipolar contribution to the anomalous thermal conductivity, because other possible causes, such as an exciton contribution, do not give corresponding compon- ents to the R-L effect. L.Pincherle

536.21

10894. ON THE THERMAL CONDUCTIVITY OF MOLECULAR CRYSTALS WITH INTERNAL ROTATION. V.Sergiescu.
Rev. de Physique (Bucarest), Vol. 3, No. 3-4, 219-25 (1958).

A simplified theoretical treatment, assuming that the anharmon- ic terms in the intermolecular forces depend linearly on the inter- nal rotation parameter. R.G.Chambers

536.21 : 539.531

CORRELATION BETWEEN HARDNESS AND THERMAL CON- DUCTIVITY OF NONMETALLIC CRYSTALS. See Abstr. 10334.

536.212

10895. MEASUREMENT OF THE THERMAL CONDUCTIVITY IN SEMICONDUCTORS. R.Nii.
J. Phys. Soc. Japan, Vol. 13, No. 7, 769-70 (July, 1958).

The thermal conductivity of Bi_2Te_3 and PbTe has been measured

by the Angström method. The temperature dependence of the temperature conductivity is shown for Bi_2Te_3, and of the thermal conductivity for PbTe. The latter results agree well with Price's model (Abstr. 2861 of 1956). W.Bardsley

536.212.2

10896. THERMAL CONDUCTIVITY BETWEEN 80° AND 480°K OF TELLURIUM WITH VARIOUS AMOUNTS OF IMPURITIES. E.D.Devyatkova, B.Ya.Moizhes and I.A.Smirnov.
Fiz. tverdogo Tela, Vol. 1, No. 4, 613-27 (April, 1959). In Russian.

Three monocrystals of tellurium, with hole densities of 10^{15}, 9×10^{16} and 5×10^{18} cm^{-3}, were investigated. In the crystal with 5×10^{18} cm^{-3} hole density, the thermal conductivity (from which the electron part was subtracted) varied as T^{-1}, i.e. in the same way as the thermal conductivity of the lattice of pure tellurium. In purer samples, an additional thermal conductivity was observed, which was due to energy transfer by electromagnetic radiation. A.Tybulewicz

536.212.2 : 537.311.31

THERMAL CONDUCTIVITY OF MONOVALENT METALS. See Abstr. 10962

536.212.3

10897. DETERMINATION OF THE THERMAL CONDUCTIVITY OF VULCANIZED RUBBER AS A FUNCTION OF EXTENSION. H.Tautz.
Exper. Tech. der Phys., Vol. 7, No. 1, 1-14 (1959). In German.

The apparatus is described in full and illustrated. The samples consist of vertical loops of fibres (about 0.6 mm diameter) in vacuo fastened at their upper ends to a heater (at about 90° C) and the lower loop end attached to the junction of a Cu-constantan thermocouple. The thermocouple wires, 0-190 mm diameter and of known thermal conductivity, are vertical, taut and separately attached at their lower ends to a water-cooled copper base plate. The method consists of a comparison of the thermal conductivities of the stretched fibres with that of the thermocouple wires. It is assumed that radiation may be neglected. Results, shown graphically, for eight different samples indicate that the thermal conductivity increases with extension. S.Weintroub

536.212.3

10898. THE THERMAL CONDUCTIVITY OF GRAPHITE IN THE VICINITY OF THE SUBLIMATION TEMPERATURE. W.F.Anacker and R.Mannkopff.
Naturwissenschaften, Vol. 46, No. 6, 199-200 (1959). In German.

Describes how the thermal conductivity k may be obtained using the apparatus described by Anacker and Mannkopff [Verband Deutschen Physikalischer Gesellschaften, Vol. 5, 55 (1954)]. It gives k = 0.037 to 0.077 W/(cm deg K) below the sublimation temperature 3995°K, and the values are compared with those of Euler (Abstr. 6207 of 1957). S.Weintroub

536.212.3

10899. THE THEORY OF THERMAL CONDUCTION IN INSULATORS. I-II. H.Paul.
Z. Naturforsch., Vol. 14a, No. 5-6, 535-40, 540-7 (May-June, 1959).

In Pt I, a comprehensive theory, which covers both Peierls' (Abstr. 1912 of 1930) and Casimir's (Abstr. 3301 of 1938) methods, is derived by combining Peierls' phonon theory with Lebowitz and Bergmann's concept of temperature baths (Abstr. 9146 of 1957). The value obtained for the conductivity at high temperatures is the same as that given by Peierls' theory. In Pt II, the theory is applied to the case of a long cylindrical specimen at low temperatures. An integral equation is obtained which is solved by approximations. The solution for the conductivity λ agrees with the value given by Casimir, but a temperature can be assigned only to those points of the cylinder which are in contact with the baths. For a flat box specimen of thickness D, $\lambda \propto DT^3$ for $T \to 0$, when phonon–phonon interaction is neglected. The interaction is shown to introduce an additional term in λ, which, to a first approximation, is proportional to D^3T^5. S.Weintroub

536.23 : 537.56

10900. CALCULATION AND MEASUREMENT OF THE THERMAL CONDUCTIVITY OF NITROGEN UP TO 13 000°K. F.Burhorn.
Z. Phys., Vol. 155, No. 1, 42-58 (1959). In German.

The thermal conductivity for temperatures up to 25 000°K of a nitrogen plasma is calculated in accordance with Meixner (Abstr. 794 of 1953). It consists of the normal classical conductivity, that due to thermo-diffusion and the diffusion thermo-effect, and that due to the reaction velocity. The experimental measurements were made up to 13 000°K on a wall-stabilized cylindrical arc of 5 mm cross-section and at currents of 100 A. The temperature distribution was determined spectroscopically using three different methods: (1) the Stark width of H_β (the nitrogen contained a small amount of hydrogen); (2) the continuum radiation intensity at 6130 A; and (3) the intensities of the N-lines at 4935 A and 3996 A. The results are shown graphically. The conductivity was obtained directly from the Elenbaas–Heller equation. The maximum in the thermal conductivity occurred at 7000°K. The agreement between the theoretical and experimental curves indicates the existence of large dissociation heat transfer. There is also a high ionization contribution. S.Weintroub

536.23

10901. SECOND APPROXIMATIONS FOR THE STRESS TENSOR AND THE HEAT FLUX IN A GAS. Hsun-Tiao Yang.
Phys. of Fluids, Vol. 2, No. 2, 237-8 (March-April, 1959).

536.23 : 533.7

THERMAL CONDUCTIVITY OF MULTICOMPONENT GAS MIXTURES. See Abstr. 10692

536.24 : 532.517.2

10902. HEAT TRANSFER TO LAMINAR FLOW BETWEEN PARALLEL PLATES WITH A [SYMMETRICALLY] PRESCRIBED WALL HEAT FLUX. R.D.Cess and E.C.Shaffer.
Appl. sci. Res. A., Vol. 8, No. 5, 339-44 (1959).

The first three eigenvalues and constants, as well as asymptotic expressions for these quantities, are presented.

536.24 : 532.517.4

10903. ON THE EDDY DIFFUSIVITIES FOR MOMENTUM AND HEAT. C.L.Tien.
Appl. sci. Res. A, Vol. 8, No. 5, 345-8 (1959).

From a simple consideration, the eddy diffusivities are shown to be equal in terms of the statistical properties of turbulence. A universal semi-empirical expression for the eddy diffusivities in a turbulent shear flow is obtained in terms of the distance from the solid boundary and flow properties.

536.24 : 532.517.2

10904. THE GROWTH OF THE THERMAL BOUNDARY LAYER IN LAMINAR FLOW BETWEEN PARALLEL FLAT PLATES. A.McD.Mercer.
Appl. sci. Res. A, Vol. 8, No. 5, 357-65 (1959).

The problem considered is that of the heat transfer occurring at the inlet to a parallel plate channel. Instead of separating variables, the energy equation is solved, after transformation, in the form of a power series. This method supplies information concerning the initial growth of the thermal boundary layer, which is not obtainable by previous methods using eigenfunction expansions. A sufficient number of coefficients of the series is computed to allow the present solution to be joined to the asymptotic eigenfunction solution, thus completing the treatment of the problem for all values of the longitudinal variable.

536.24 : 532.517.4

10905. HEAT TRANSFER TO TURBULENT NON-NEWTONIAN FLUIDS. A.B.Metzner and P.S.Friend.
Industr. engng Chem., Vol. 51, No. 7, 879-82 (July 1959).

An analysis of turbulent heat transfer rates to fluids flowing in smooth, round tubes. Extensive experimental data on slurries and polymer solutions are presented, covering the range of Prandtl numbers from 6.3 to 190, and of Reynolds numbers up to 71 000.

536.242

10906. TEMPERATURES IN HEATED FINITE SLABS WITH FOURTH-POWER LOSS. R.Greenstone.
J. Washington Acad. Sci., Vol. 48, No. 11, 341-6 (Nov., 1958).

Temperature rises in slabs heated at a constant rate are calculated for several thicknesses of slab, and the transitions from thin-isothermal to finite, and from finite to semi-infinite, temperature behaviour, are demonstrated. The distinctions between these behaviours are dependent on the physical thickness of the slab and on time. Dusinberre's finite difference method of analysis is used. The results are shown graphically. S.Weintroub

536.253 : 551.524.4

10907. THE CONVECTIVE REGIME AND TEMPERATURE DISTRIBUTION ABOVE A HORIZONTAL HEATED SURFACE. J.F.Croft.
Quart. J. Roy. Meteorol. Soc., Vol. 84, 418-27 (Oct., 1958).

The convective flow and temperature distribution above a horizontal heated surface in air have been examined by optical methods.

ention has been given both to the open system and to enclosed air ers. The observations show the existence close to the surface of ode of convection similar to the cellular convective motion viously noted in shallow enclosed layers. This motion is found e present both in the open system and in the lower part of an losed layer of wide separation, i.e. large Rayleigh number. e mean temperature profile in this region has been found for a ge of surface temperatures and the results show that the loga- m of the mean absolute temperature (T) varies as the power) of the height (Z) above the heated surface. This measured tribution has been compared with theoretical predictions, in ticular that of the Priestley similarity theory, which properly ers to convection above an infinite surface and in which the tulated conditions will apply more exactly in higher layers. vertheless the measured temperature profile in the surface region of the form predicted by the Priestley theory with the experi- ntal value ($-\frac{1}{2}$) in place of the theoretical ($-\frac{1}{3}$) as the power of height (Z).

536.33

908. ON THE RECIPROCAL RADIATION BETWEEN TWO RTIALLY REFLECTING SURFACES. J.Gosse.
t. Acad. Sci. (Paris), Vol. 248, No. 10, 1483-5 (March 9, 1959). French.

An expression for the flux of heat radiation exchanged between bodies of any shape is calculated. Successive reflections are en into account and it is assumed that Lambert's law applies

S.Weintroub

536.33.08

909. SENSITIVITY AND NATURAL LIMITATIONS OF NICKEL OLOMETERS. G.Barth and W.Maier.
n. Phys. (Leipzig), Folge 7, Vol. 3, No. 5-6, 260-82 (1959). German.

A comprehensive account of the performance of nickel bolo- ters. Measurements are given of temperature coefficients, quency response, time constants, thermal capacity, noise, etc., d the variation of response with ambient temperature and pressure. useful comparison is made with other thermal receivers. A table ows the performance figures for 24 receivers of different types.

R.W.Fish

536.4.031

910. ON THE LIMIT OF SUPERHEAT.
Wakeshima and K.Takata.
Phys. Soc. Japan, Vol. 13, No. 11, 1398-403 (Nov., 1958).

A new method of observing the limit of superheat was devised, which small drops of a sample liquid are heated as they rise up the non-soluble heating liquid with a suitable upward temperature adient. The limit of superheat was determined, mainly for some turated hydrocarbons and polymethylenes. The result was com- red with Doring's theory of spontaneous bubble formation in super- ated liquids. The agreement between the theory and experiment s satisfactory, which seems to throw some light upon the problem surface free energy on the nuclear bubble.

536.41

911. THE COEFFICIENTS OF EXPANSION OF SOLID AND QUID METALS AND SEMI-METALS.
Schneider and G.Heymer.
turwissenschaften, Vol. 46, No. 5, 167 (1959). In German.

The ratio of the expansion coefficients for the solid and liquid ates lies between 0.73 and 1.04 for metals and between 0.30 and 45 for semi-metals. These facts, together with the observation at the corresponding ratios for NaTl and LiCd lie between the lues for metals and semi-metals, are considered in the light of rrent ideas on valency.

J.Thewlis

536.413

912. THE ANOMALOUS THERMAL EXPANSION OF SOME ARE EARTH METALS. B.S.Chandrasekhar.
cta metallurgica, Vol. 6, No. 3, 212-14 (March, 1958).

The thermal expansion anomalies in gadolinium, terbium, and sprosium are shown to be consistent with Zener's views (1955) the exchange interaction between unfilled electron shells. The in alignment in antiferromagnetic dysprosium is inferred. The ssibility of extending the model to the actinide elements is ggested.

536.413.2

913. STRESS-ORDERING EFFECT ON THERMAL EXPANSION F CuAu SINGLE CRYSTALS. M.Hirabayashi.
Phys. Soc. Japan, Vol. 14, No. 2, 149-52 (Feb., 1959).

The linear thermal expansion of CuAu single crystals was measured. When a bar-formed specimen was slowly cooled from above the transition temperature under compressive stress along its longitudinal direction, it was confirmed that the c-axes of the ordered phase were predominantly lined up in one of the cubic axes nearest to the stress direction. Furthermore a linear relationship was established to hold between the compressive stress previously applied and the amount of the dilatometric change due to the order—disorder transition. However, even when some of the crystals were initially annealed free from external stress, the tetragonal c-axes were not distributed statistically along the three original cubic axes.

536.421.1

10914. SOME THEORETICAL ASPECTS OF MELTING. C.Domb.
Nuovo Cimento Suppl., Vol. 9, No. 1, 9-26 (1958).

A Lindemann-type law of corresponding states for the melting temperature is derived by considering the configurational partition function. Other related topics are discussed, including volume and entropy changes on melting, quantum effects, the possibility of a critical point for melting, and the analogy of melting with the transition in an Ising antiferromagnetic system.

J.Hawgood

536.422.1

10915. IMAGE FORMATION OF A HIGH TEMPERATURE VACUUM EVAPORATION SOURCE THROUGH COMBINED DISTILLATION CAMERA EXPOSURES AND AUTORADIOGRAPHY WITH Au^{198}, Cr^{51} AND W^{185}. L.E.Preuss.
Internat. J. appl. Radiation and Isotopes, Vol. 3, No. 2, 143-55 (1958).

A combination of vacuum distillation self-imaging and autoradiography is described for the production of an image of the vacuum evaporation geometry of an evaporating source at the instant of molecular distillation, or during selected periods throughout the distilling sequence. The mode of the macrodistillation phenomena may be ascertained by the method, which is particularly applicable to the study of distillation phenomena of minute masses of charge material. The system provides an image, the density of which quantitatively represents the intensity of the evaporation rate from any point on the distillation source. A shutter system may be used to provide discrete images of the distillation phenomena at limited, selected time periods throughout the evaporation. The method consists first of the use of a simple vacuum distillation camera. The image of the source being formed on a cold target plate at the image plane and made up of the condensed metal distilland, tagged with its radioactive isotope. Single isotopes or combinations of the tagged metals may be used in the crucible and charge. Radioisotopes used are Au^{198}, Cr^{51} and W^{185}. The metallic condensed metal in image array may be so tenuous as to be invisible on this target plate. This condensed tagged metal is placed in gross apposition with a proper autoradiographic emulsion and the resultant photographic negative presents the true image of the distillation intensities at the source. This image may not necessarily coincide with the geometric, mechanical limits of the filament plus charge. The autoradiographic image reproduces the apparent source seen by the target. This special benefit of the method, in that it demonstrates the source region from which the distilling atoms emanate, allows study of wetting phenomena, creep of charge, reflection and distilland scattering phenomena. Image photographic density may be a quantitative measure of the source distillation rate, when the photographic process is standardized. The method has potential in binary isotope distillations to determine simultaneous evaporation phenomena of charge and crucible. The resolution theoretically extends to the order of 10 μ and has a sensitivity down to 500 μg charge mass distilled. Source images may consist of as little as 10^{-10} g of metal for certain beta-emitters.

536.422.1

10916. THE DISSOCIATION PRESSURE OF $ZnAs_2$. V.J.Lyons.
J. phys. Chem., Vol. 63, No. 7, 1142-4 (July, 1959).

Two standard methods have been employed to measure the dissociation pressure of $ZnAs_2$ in the range from 612° to 770°C. A dew-point method was used from 612° to 759°C and triple-point measurements covered the range 756° to 770°C. The melting point of the compound was found to be 768 ± 1°C at an arsenic pressure of 3.3 atm. In the temperature range from 612° to 740°C the data may be represented by the equation $\log P = -12300/T + 15.0$. The heat of dissociation calculated from the slope of the equation is 18.8 kcal/mole.

536.422.1

10917. THE DISSOCIATION PRESSURE OF ALUMINUM CARBIDE. D.J.Meschi and A.W.Searcy.
J. phys. Chem., Vol. 63, No. 7, 1175-8 (July, 1959).

The vapour pressure of Al_4C_3 has been measured in the region from 1500° to 1800° K by means of the Knudsen effusion method and of a torsion method. ΔH° at 1600° K was calculated for the reaction $Al_4C_3(s) \rightarrow 4Al(g) + 3C(s)$ by means of the second and third law, and respective values of 89 (±3) kcal/mole Al and 87 (±3) kcal/mole Al were obtained. The results indicate carbon content of no more than 2% in the vapour when aluminium carbide is dissociated at 1600° K.

536.422.1 : 537.533

THE EVAPORATION OF OXIDE COATED CATHODES.
See Abstr. 9689

536.423.1

10918. PARTIAL VAPOR PRESSURE AND ENTROPY OF SOLUTION OF IODINE. J.Walkley and J.H.Hildebrand.
J. phys. Chem., Vol. 63, No. 7, 1174 (July, 1959).

Measurements of the partial vapour pressure of iodine at 25° C from its solutions in CCl_4 and CS_2 are reported, giving values $(\partial \ln p_2/\partial \ln x_2)_T$ of 0.98 and 0.86, respectively. These are combined with values of $R(\partial \ln x_2/\partial \ln T)$ from solubility to give for the entropy of solution of solid iodine, 21.5 and 16.2 cal deg^{-1} $mole^{-1}$, respectively. These values are independent of the assumptions contained in regular solution theory, including extrapolated properties of liquid iodine.

536.445

10919. PHASE SEPARATION AND CRITICAL POINT IN MIXTURES OF LIQUIDS AND IN ALLOYS. A.Münster and K.Sagel.
Z. Elektrochem., Vol. 62, No. 10, 1075-82 (1958). In German.

For a binary alloy the critical point is approached by an analytical expression for the difference in the densities of coexisting phases that is noticeably different from that for a binary liquid. In analogy to the opalescence of liquids in the immediate neighbourhood of the critical point, a steep increase in intensity of the low-angle scattering of X-rays has been observed for Al–Zn near its critical point (351.5° C). An indication of such opalescence has also been found with Au-Ni near 810° C. R.Schnurmann

536.48

10920. A SIMPLE LIQUID AIR TRANSFER VALVE FOR CONTROLLED EVAPORATION. J.K.N.Sharma.
Curr. Sci., Vol. 28, No. 5, 195 (May, 1959).

This valve consists of a stainless steel cone in a phosphorbronze seating. It is operated by a long, hollow stainless-steel piston whose threaded part is at a considerable distance from the valve. The piston is kept in the horizontal position so that the liquid which is to be transferred has not to do work against the weight of the stainless-steel knob. R.Schnurmann

536.48

10921. BOSE–EINSTEIN STATISTICS AND HELIUM FILMS. A.D.Singh and R.K.Pathria.
Nature (London), Vol. 183, 668 (March 7, 1959).

If the film thickness d becomes comparable with the mean de Broglie wavelength $\lambda = h(2mkT_0)^{-1/2}$, where T_0 is the transition temperature, a decrease of T_0 with d can be deduced from the ideal Bose–Einstein gas model. The result: $T_0/T_0^* = (1 + 0.352\lambda/d)^{-2/3}$ (T_0^* = bulk liquid lambda-point) is in fairly good agreement with experiments by Long and Meyer (Abstr. 6989/1955). H.London

536.48

10922. THE λ-TRANSITION IN HELIUM. C.G.Kuper.
Nature (London), Vol. 183, 1544-5 (May 30, 1959).

A phenomenological model is suggested for the dependence on temperature of the minimum roton energy in liquid helium; this model is one which will produce a specific heat anomaly at the λ-point similar to that observed and will also agree with observations made in neutron scattering experiments. It implies that the minimum roton energy does not vanish at the transition; it is thought that an experimental test of this by neutron scattering might be difficult owing to high line-width; the absence of superfluidity above the λ-point is also stated to require further explanation. L.Mackinnon

536.48

10923. THE DIFFUSION COEFFICIENT IN DILUTE H_2–D_2 AND ^{3}He–^{4}He LIQUID MIXTURES.
G.Careri, J.Reuss and J.M.Beenakker.
Nuovo Cimento, Vol. 13, No. 1, 148-53 (July 1, 1959).

An apparatus has been built to measure the diffusion coefficient in liquids at very low temperatures. This technique has been applied to hydrogen–deuterium dilute mixtures, and the results can be expressed by an Arrhenius type equation as function of the absolute temperature $D = 64 \exp[48/T] \times 10^{-5}$ cm²/sec. The same technique was more difficult to use for the helium isotope mixtures. The results are affected by large errors and roughly $D = (4 \pm 2) \times 10^{-5}$ cm²/sec in the temperature range above the λ point.

536.48

10924. SPIN–LATTICE RELAXATION TIME IN LIQUID ^{3}He.
G.Careri, I.Modena and M.Santini.
Nuovo Cimento, Vol. 13, No. 1, 207-18 (July 1, 1959).

The spin–lattice relaxation time T_1 has been measured in liquid He^3 from 1.1 to 3° K at its saturated pressure. The results indicated a sharp increase of T_1 decreasing the temperature below 1.4° K. This behaviour cannot be accounted for by the Bloembergen, Purcell and Pound theory.

536.48

10925. THEORY OF THE SUSCEPTIBILITY AND SPECIFIC HEAT OF He^3. S.Yomosa.
Progr. theor. Phys., Vol. 17, No. 3, 487-503 (March, 1957).

A gas model taking account of interatomic interactions is proposed for liquid He^3. Assuming that the interaction potential can be decomposed into Fourier components, $4\pi g(k)e^{ik\cdot r}$ (r = interatomic distance), the motion of the system is described using the method of Bohm and Pines. If one regards the expansion coefficients $c_0, c_2, \ldots$ of g(k) in powers of k as parameters and presumes suitable values of these parameters with reference to the value of sound velocity proposed by Mikura, the experimental data of nuclear susceptibility χ and specific heat C_V, it can be shown that the number of collective modes is of the order of one percent of the total degrees of freedom, so that the influence of the collective motion on χ and C_V is negligible in the vicinity of 0° K. The deviations of χ and C_V from those which follow from the simple free-particle theory arise mainly from the exchange interactions. Considering only these exchange energies but neglecting the influence of the collective motion, one can explain the temperature dependence of χ in the whole temperature range provided that account is taken of the k-dependence of the exchange energy per particle, while the temperature dependence of C_V is explained only up to 0.3° K.

536.48

10926. FILM FLOW FROM A ROTATING BEAKER OF HELIUM TWO. H.A.Snyder and R.J.Donnelly.
Phys. of Fluids, Vol. 2, No. 4, 408-15 (July–Aug., 1959).

A cylindrical Pyrex beaker of internal radius 0.318 cm containing He II was rotated about its principal axis at angular velocities ranging from 4 to 220 rad per second. The film flow rate during rotation was compared with the stationary rate by observing the rate of fall of the meniscus in rotation and at rest. No change in film flow rate greater than the scatter of individual runs (±4%) was observed over the entire range of rotation speeds. Deliberate introduction of contamination increased the creep rate but did not otherwise alter the above conclusion. A number of subsidiary experiment necessary to confirm the main conclusions are discussed.

536.48

10927. POSSIBLE DETERMINATION OF THE HELICITY OF ELEMENTARY EXCITATIONS IN LIQUID He II.
T.D.Lee and F.Mohling.
Phys. Rev. Letters, Vol. 2, No. 7, 284-5 (April 1, 1959).

"Helicity" is defined as the component of angular momentum along the wave vector of the excitation. It is shown how the helicity could be found experimentally from small-angle inelastic neutron scattering intensity measurements. Existing measurements already give an indication that the excitations excited by neutrons are longitudinal, but a direct experimental determination of the helicity would be desirable. O.Penrose

536.48

10928. OBSERVATION OF A λ-TRANSITION IN HELIUM FOR HEAT FLOW THROUGH A PHASE BOUNDARY. V.P.Peshkov.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1350-4 (1958). In Russian

Experiments are described on the observation of a density and temperature discontinuity on the boundary between superfluid and non-superfluid helium in the presence of a heat flow. The reasons for the stability of the boundary are explained and some examples given of violation of the stability at large densities of the heat flow.

536.48

10929. HEAT FLUSH AND MOBILITY OF ELECTRIC CHARGES IN LIQUID HELIUM. I. NON TURBULENT FLOW.
G.Careri, F.Scaramuzzi and J.O.Thomson.
Nuovo Cimento, Vol. 13, No. 1, 186-96 (July 1, 1959).

In order to check quantitatively the Landau–Pomeranchuk

picture of the movement of foreign atoms in liquid helium II, an experiment has been performed in which some elementary charged particles could be dragged perpendicular to their motion in an electric field by a stream of excitations in non-turbulent flow. Using known values for the mobility of charged particles in He II, the drift velocity of the charges parallel to the stream of excitations has been found to be equal to the normal fluid velocity in the temperature range above 1.18°K. Working under similar conditions, the apparatus has then been used to obtain mobilities at temperatures near 1°K. The mobility is found to go exponentially with decreasing temperature, and this behaviour is discussed in terms of elastic scattering of the charges by the rotons.

536.531

10930. PRECISION THERMOMETER SYSTEM FOR THE LIQUID HELIUM REGION. B.J.Sandlin and J.C.Thompson.
Rev. sci. Instrum., Vol. 30, No. 8, 659-61 (Aug., 1959).

The system uses a carbon resistor (Allen-Bradley type) as the sensing element. The resistor is in the frequency determining circuit of a stabilized Wien bridge oscillator. Thus temperature changes are displayed as frequency shifts. The frequency is read directly from a Hewlett-Packard type 523 B counter. When operated in the neighbourhood of 100 kc/s at 4.2°K the sensitivity is approximately 50 kc/s per deg K. This corresponds to a temperature resolution of 20 μdeg, when used with the above counter. Resolution can be improved by observing higher harmonics. The power input to the resistor is of the order of 10^{-2} μW. The time for a temperature measurement is 1 sec, and response times to changes are limited only by equilibrium in the thermometer. Absolute accuracy is essentially limited only by the determination of the helium vapour pressure during calibration.

536.58

10931. ON MAINTAINING AN OBJECT AT A UNIFORM TEMPERATURE. C.M.Carmichael and A.D.Misener.
Canad. J. Phys., Vol. 37, No. 7, 890-3 (July, 1959).

The apparatus consisted of a sealed 18 in. long, 6 in. dia. steel chamber with heating coils wound on its outer surface. A 12 in. copper cylinder of 4 in. dia., supported inside the steel chamber, acted as a uniform temperature enclosure and objects of various shapes and thermal conductivities were suspended on nylon threads inside the enclosure. A pressure of 10^{-2} mm Hg was maintained in the apparatus to eliminate convection. Two types of measurement were made (within range 20° to 100°C) to investigate the equilibrium temperature over the surface of an object in relation to the temperature over the enclosure surface. In the first, the copper enclosure was maintained at uniform temperature (to within about 0.003°C) and the temperature of the object showed a standard deviation of about 0.002°C. There was considerable drift. In the second, a temperature gradient was set up along the length of chamber, enclosure and object, of up to 2°C. There was approximately a 10-fold reduction in gradient from chamber to enclosure to object.

S.Weintroub

536.63

10932. DEBYE θ OF HEXAGONAL CRYSTALS AT 0°K. N.M.Wolcott.
J. chem. Phys., Vol. 31, No. 2, 536-40 (Aug., 1959).

A set of numerical tables is given which permits the easy calculation of the Debye characteristic temperature at 0°K of any crystal with hexagonal symmetry. The use of the tables presupposes a knowledge of the elastic constants, atomic volume, and density of the crystal. Values of the characteristic temperature obtained with the use of the tables are compared with those obtained by direct calculation in a number of special cases.

536.631

10933. THE SPECIFIC HEAT OF RUBIDIUM BETWEEN 1.2 AND 4.2°K. F.D.Manchester.
Canad. J. Phys., Vol. 37, No. 4, 525-8 (April, 1959).

The electronic contribution was too small to detect; the Debye θ passed through a minimum of 51.2°K at 2.8°K, and flattened off to 52.6°K below 1.6°K.

R.G.Chambers

536.631

10934. THE HEAT CAPACITY, ENTROPY AND HEAT CONTENT OF SODIUM AMIDE FROM 15 TO 300°K. THE THERMODYNAMICS OF AMIDE ION IN LIQUID AMMONIA.
L.V.Coulter, J.R.Sinclair, A.G.Cole and G.C.Roper.
J. Amer. Chem. Soc., Vol. 81, No. 12, 2986-9 (June 20, 1959).

Determined in an adiabatically operated calorimeter. At 298.15°K, the heat capacity, entropy and enthalpy were found to be 15.81 cal deg^{-1} $mole^{-1}$, 18.38 cal deg^{-1} $mole^{-1}$ and 2841.6 cal/mole, respectively. At 240°K, the standard free energy of formation of ammonous amide ion in the hypothetical 1 molal ammonia solution is 30.5 kcal and the partial molal entropy of amide ion is −19.3 cal deg^{-1} $mole^{-1}$ relative to $\bar{S}_{240}[H^+(am)] = 0.0$. In comparison with other negative ions the observed entropy of the amide ion in liquid ammonia appears qualitatively correct for a freely rotating ion. For the reaction: $NH_3(l) = H^+(am) + NH_2^-(am)$ the ionization constant $K = 3.2 \times 10^{-33}$ at 240°K. At 298.15°K, $\Delta F^0_f[NH_2^-(am)] = 35.0$ kcal; $\bar{S}^0[NH_2^-(am)] = -14.7$ cal deg^{-1} $mole^{-1}$ and $K = 2.2 \times 10^{-28}$ for the ionization of liquid ammonia.

536.631

10935. EFFECTIVE EXCHANGE CONSTANT IN YTTRIUM IRON GARNET. D.T.Edmonds and R.G.Petersen.
Phys. Rev. Letters, Vol. 2, No. 12, 499-500 (June 15, 1959).

The specific heat consists of two parts, which show different temperature dependence. One part is due to the lattice and gives a Debye temperature of 454°K. The other part is the spin-wave contribution and gives the Landau—Lifshits exchange constant as 0.192×10^{-6} erg/cm, similar to that of magnetite and an order smaller than that of iron. The frequency for maximum coupling of the uniform precessional mode to transverse phonons via the z-directed spin-waves is 28.3 kMc/s and the wavelength 1.05 cm.

R.C.Kell

THERMODYNAMICS

536.7 : 541.124

10936. THE THERMODYNAMICS OF GAS REACTIONS. M.af Hällström.
Ann. Acad. Sci. Fennicae AII, No. 95,12 pp. (1959). In German.

A condensed résumé is given of the principal relationships between the fundamental thermodynamic functions as applied to gases and gaseous reaction equilibria.

W.Good

536.7

10937. THERMODYNAMIC PROPERTIES OF SOME BORON—OXYGEN—HYDROGEN COMPOUNDS. R.L.Wilkins and R.L.Altman.
J. chem. Phys., Vol. 31, No. 2, 337-40 (Aug., 1959).

The heat capacity, enthalpy, and entropy of gaseous B, B_2, BH, BO, and B_2O_2 have been calculated in the ideal gas state from 0 to 6000°K by standard methods of statistical mechanics with available spectroscopic data.

536.7 : 530.162

10938. A NOTE ON THERMODYNAMICS OF THE HARMONIC OSCILLATOR WITH RADIATION DAMPING. N.Saitô and J.Hori.
J. Phys. Soc. Japan, Vol. 13, No. 7, 717-21 (July, 1958).

Previously one of the authors showed that a system with positive real impedance can be described within the framework of irreversible thermodynamics. In this paper it is noted that the impedance of the system which is describable by irreversible thermodynamics should necessarily be positive real. This conclusion is immediately drawn from the theorem of network synthesis that a system with non-positive real impedance cannot be constructed from elementary RLC circuit. That a system is constructedm from RLC circuit is the necessary and sufficient condition for the system to be described by irreversible thermodynamics. Some statistical properties of the harmonic oscillator with radiation damping are examined, this being a typical example of the system with non-positive real impedance. In the presence of radiation damping, the Fokker—Planck equation for the fluctuation cannot be set up without having recourse to an approximation. The result of this approximation is however at variance with the requirement of the rigorous irreversible-thermodynamical description.

536.7 : 537.312.62

THERMODYNAMIC FUNCTIONS OF THE SUPERCONDUCTOR. See Abstr. 9663

536.7 : 537.56

THERMODYNAMIC THEORY OF A PLASMA. See Abstr. 9727

536.7 : 532.77

THE VOLUMETRIC AND THERMODYNAMIC PROPERTIES OF FLUIDS. TWO COMPONENT SOLUTIONS. See Abstr. 10682

536.71 : 541.121

10939. LIQUID ISOCHORES AND DERIVED FUNCTIONS OF $n-C_7F_{16}$, $c-C_6F_{11}CF_3$, $c-C_4Cl_2F_6$, $n-2,2,3C_4Cl_3F_7$, $CCl_2F \cdot CCl_2F$, AND CCl_4. E.B.Smith and J.H.Hildebrand.
J. chem. Phys., Vol. 31, No. 1, 145-7 (July 1959).

Values of the function, $(\partial P/\partial T)_V$ were determined for six liquids through ranges of 1-60 atm and initial temperature ranges as high as 25°C. The values at 1 atm and 25°C in atm deg^{-1} and the compressibilities $\times 10^4$ calculated from them are, respectively, C_7F_{16} 7.10, 2.34; $c-C_6F_{11}CF_3$ 7.53, 2.18; $c-C_4Cl_2F_6$ 8.61, 1.76; $n-C_4Cl_3F_7$ 8.97, 1.41; $CCl_2F \cdot CCl_2F_2$ 8.67, 1.50; CCl_4 11.22, 1.23. Since $(\partial^3 P/\partial T^3)_V = 0$ in the range of the observations, $(\partial E/\partial V)_T$ is a pure volume function, but $v^2(\partial E/\partial V)$, (v is molal volume) is not strictly constant, as it would be for a van der Waals liquid, but the drift is substantially reduced, and the relation between $\partial E/\partial V$ and ΔE^{vap}, the energy of vaporization per mole, are both consistent with the relations: $v^{n+1}(\partial E/\partial V) = nv^n\Delta E^{vap}$ = const with values of n having the following values, in the order of liquids given above: 1.49, 1.44, 1.35, 1.36, 1.19, 1.09. These relations are explained qualitatively in terms of the expression derived by Hildebrand and Wood (see Abstr. 72 of 1934) for the potential energy of a liquid in terms of its distribution function and intermolecular pair potentials.

536.712

10940. EQUATION OF STATE FOR FLUIDS SORBED IN POROUS CRYSTALS. R.M.Barrer and L.V.C.Rees.
Trans Faraday Soc., Vol. 55, Pt 6, 992-8 (June, 1959).

An equation of state, which gives correctly the P, V, T relations of some three-dimensional fluids up to critical densities, has been used to express isotherms of argon and nitrogen sorbed within certain porous crystals. The equation, in the appropriate range of densities of sorbed fluids, has been successfully modified by introducing a thermal entropy correction and a correction for the smaller number of sorbate–sorbate contacts within the porous crystals.

536.76

10941. ON THE EQUATION OF THE MELTING CURVE. A.V.Voronel'.
Zh. tekh. Fiz., Vol. 28, No. 11, 2630-4 (1958). In Russian.

It is shown that the empirical Simon–Glatzel equation for the melting point as a function of pressure may be obtained from the Clausius–Clapeyron equation by assuming that the latent heat divided by the volume change on melting is a linear function of pressure; this assumption is equivalent to taking the fraction of the latent heat used in overcoming the internal pressure as constant along the melting curve. A relationship is predicted between the two constants of the Simon–Glatzel equation; a test on 14 substances showed it to be true to within ~ 5% for 12 of them, but there were discrepancies of 11% and 20% for N_2 and K respectively. K.F.Hulme

536.77 : 537.56

THERMODYNAMIC PROPERTIES OF A DEGENERATE PLASMA. See Abstr. 9732

536.77 : 537.312.62

LOWEST FREE ENERGY STATE. BLOCH'S THEOREM. See Abstr. 9662

536.79 : 533.6.011

TOTAL ENTHALPY IN EXPANDING GAS FLOW. See Abstr. 10687

ELECTRICITY

ELECTROSTATICS . DIELECTRICS

537.2 : 550.817.3

10942. POTENTIAL DISTRIBUTION DUE TO A CYLINDRICAL ELECTRODE MOUNTED ON AN INSULATING PROBE. L.de Witte and R.W.Gould.
Geophysics, Vol. 24, No. 3, 566-79 (July, 1959).

The potentials around a finite cylindrical electrode can be obtained by dividing the electrodes into rings of equal thickness and substituting an infinitely thin current ring for each of the slices. The field of an infinitely thin ring electrode mounted on an insulating cylindrical probe of the same diameter can be found by combining the properties of the delta function with a solution of Laplace's equation in cylindrical co-ordinates. Combination of solutions for the infinitely thin rings under the condition that the potential of the electrode surface be constant leads to a system of simultaneous linear equations. By increasing the number of slices, the potential around the finite electrode can be found arbitrarily close. The problem of a cylindrical electrode on a sonde located coaxially in a conducting hole, drilled through a medium of different conductivity, is treated by the same method. This arrangement is of interest in electrical logging of drill holes. Numerical examples have been calculated. The potential along the surface of the insulating probe, at distances larger than twice the electrode length, can be approximated with good accuracy by assuming that all of the current is emitted from an infinitely thin ring located in the median plane of the electrode.

537.222 : 539.27

ELECTRON-OPTICAL METHOD OF STUDYING MICRO-DISTRIBUTIONS OF ELECTRIC FIELDS. See Abstr. 10309

537.226.2

10943. THE DIELECTRIC CONSTANT OF ROCK SALT AT HIGH TEMPERATURES. M.S.Kosman and N.A.Petrova.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 3, 311-14 (1958).
In Russian. English summary: PB 141041T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The high-voltage polarization does not disappear at high temperatures but degenerates into a low-voltage polarization. The absorption charges increase with temperature, and the absorption processes increase in velocity, so even high-frequency measurements may be affected at high temperatures by absorption. Potential differences are mainly concentrated near the electrodes, so that the voltage on the sample during the discharge is below the average value. The dielectric constants calculated using this voltage are very high and consistent with the observed relaxation times. R.C.Kell

537.226.2

10944. THE DIELECTRIC CONSTANT OF ZINC OXIDE WITH AN ADDITION OF BISMUTH OXIDE. M.S.Kosman and I.A.Gesse.
Izv. Akad Nauk SSSR, Ser. fiz., Vol. 22, No. 3, 315-18 (1958).
In Russian. English summary: PB 141041T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The dependence of the dielectric constant on composition and firing temperature was investigated and values of over 1200 obtained. The conductivity was high, though less than that of ZnO itself. Both properties are affected by thermal treatment. The high dielectric constants may be caused by relaxation processes of an electronic character. R.C.Kell

537.226.2

10945. THE EFFECT OF Cu, Zn AND Li IMPURITIES ON THE DIELECTRIC PROPERTIES OF ZINC OXIDE.
M.L.Blanchard and M.Martin.
J. Phys. Radium, Vol. 19, No. 7, 677-8 (July, 1958). In French.

A study of the dielectric loss in zinc oxide doped with copper, zinc or lithium, as a function of frequency and temperature, for concentrations in the range 10^{-6} to 5×10^{-3}. For ZnO:Cu the activation energy depends on the concentration and some interpretation is given. The behaviour of ZnO:Zn is similar. J.G.Powles

537.226.2 : 535.37

10946. THE PHOTODIELECTRIC EFFECT IN THE ZnS:Cu PHOSPHOR. F.I.Vergunas and O.V.Agashkin.
Optika i Spektrosk., Vol. 3, No. 4, 338-44 (Oct., 1957). In Russian.

The capacitance and the loss-angle tangent of a capacitor filled with a crystal phosphor change when the latter is illuminated. This is known as the photodielectric effect. Observations at frequencies from 30 kc/s to 6 Mc/s, at various exciting light intensities and at temperatures down to 116°K, showed that the photodielectric effect in ZnS:Cu was primarily due to conduction electrons; electrons localized at capture levels were responsible for not more than 5% of the photodielectric changes. A.Tybulewicz

537.226.2

10947. THE DIELECTRIC AND PIEZOELECTRIC BEHAVIOUR OF PYROLUSITE (POLYCRYSTALLINE ORE OF MnO_2). J.N.Das.
Z. Phys., Vol. 155, No. 4, 465-71 (1959).

The variation of dielectric constant ϵ with temperature, frequency and voltage has been studied from 200 c/s to 10 kc/s. The samples studied show a very high value of $\epsilon \cong 10^5$. The ϵ–temperature curve indicates that ϵ attains a maximum value at a temperature which varies from sample to sample. At temperatures higher than that for ϵ_{max}, ϵ decreases with temperature as $\epsilon = C/(T-\Theta)$. The dielectric constant is dependent on the frequency and has a

higher value at lower frequencies. It increases rapidly with voltage. A pyrolusite capacitor shows a hysteresis loop (electrical). Tan δ is found to depend on temperature, frequency and voltage, and attains a maximum value between 300 and 700 c/s, for a given voltage and temperature. This indicates the existence of dielectric relaxation for these specimens. Tan δ also varies exponentially with temperature. Samples of pyrolusite studied also exhibited a piezoelectric effect. The electromechanical coupling coefficient is found to vary from 2.4×10^{-5} to 8.8×10^{-5} e.s.u./dyne. Slabs cut from the samples of pyrolusite mineral were used to control the frequency of a Hartley oscillator circuit. The resonant frequency range was found to increase as the thickness of the slab was reduced.

537.226.2

10948. FERROELECTRICITY OF $NaNH_4$-TARTRATE. Y.Takagi and Y.Makita.
J. Phys. Soc. Japan, Vol. 13, No. 3, 272-7 (March, 1958).

Below the transition point 109° K a crystal plate of NaNH - tartrate shows a domain structure under a polarizing microscope if viewed in the direction parallel to the b axis. The polarization in each domain lies parallel to +b or −b axis, and can be reversed by shearing stress. The spontaneous polarization is 0.21μ Coul/cm² at 92° K and it is probably constant below the transition temperature.

537.226.2 : 539.39

10949. FERROELECTRIC AND OPTICAL PROPERTIES OF Na(K-NH_4)-TARTRATE MIXED CRYSTALS. Y.Makita and T.Takagi.
J. Phys. Soc. Japan, Vol. 13, No. 4, 367-77 (April, 1958).

The phase diagram of the mixed crystals composed of NaK tartrate and its isomorph $NaNH_4$ tartrate has been investigated over the whole range of the concentration. The properties of each phase have been studied by dielectric and pyroelectric measurements and by optical observations. In 90.5% $NaNH_4$ tartrate crystal three kinds of polymorphic modification have been found, that is, successively, a ferroelectric phase with spontaneous polarization along the crystallographic b axis, another ferroelectric phase with spontaneous polarization along the crystallographic a axis and a paraelectric phase. The phase of compositions near the pure $NaNH_4$ tartrate has been confirmed to be ferroelectric with spontaneous polarization along the b axis.

537.226.2

10950. $LiH_3(SeO_3)_2$: NEW ROOM-TEMPERATURE FERROELECTRIC. R.Pepinsky and K.Vedam.
Phys. Rev., Vol. 114, No. 5, 1217-18 (June 1, 1959).

$LiH_3(SeO_3)_2$ crystallizes in the monoclinic system and exhibits useful ferroelectric properties in the entire temperature range −196° C to 90° C. The spontaneous polarization and coercive field at room temperature are 15.0 μcoulombs/cm² and 1400 V/cm, respectively. X-ray examination reveals that the crystals belong to the space group Pn. with cell dimensions $a = 6.25_8$ A, $b = 7.88_6$ A, $c = 5.43_3$ A, $\beta = 105.2°$, and two formula units per unit cell. The polar direction is perpendicular to the (001) plane. No Curie temperature could be observed. $NaH_3(SeO_3)_2$ is not isomorphous, but is ferroelectric below −79° C.

537.226.2

10951. THE EFFECT OF PRESSURE ON ELECTRICAL PROPERTIES OF BARIUM TITANATE IN STRONG FIELDS. Ya.M.Ksendzov and B.A.Rotenberg.
Fiz. tverdogo Tela, Vol. 1, No. 4, 637-42 (April, 1959). In Russian.

The authors studied the effects of hydrostatic, two-directional and unidirectional pressure (up to 2000 kg/cm²) on permittivity and tan δ of polycrystalline $BaTiO_3$, and of hydrostatic, unidirectional pressure on the same properties of $BaTiO_3$ monocrystals. Under the action of two-directional and unidirectional pressure, changes in permittivity occur due to reorientation of domains by mechanical stresses. A.Tybulewicz

537.226.2

10952. INTERNAL FIELDS IN FERROELECTRIC $PbTiO_3$. Yu.N.Venevtsev, G.S.Zhdanov, S.P.Solov'ev and V.V.Ivanova.
Kristallografiya, Vol. 4, No. 2, 255-7 (March-April, 1959). In Russian.

Calculations of the internal field made by the Madelung—Hagedorn method (Abstr. 1617 of 1953) are reported and compared with previous calculations (1958) made by the Kozlovskiĭ method (Abstr. 3571 of 1952). Calculations carried out for model crystals based on $PbTiO_3$ enable estimates to be made of the component parts of the internal field. R.F.S.Hearmon

537.226.2 : 539.219

DIELECTRIC AND PIEZOELECTRIC PROPERTIES OF THE $(Ba,Pb)(Ti,Zr)O_3$ SYSTEM. See Abstr. 10297.

537.226.31

10953. DEBYE DIPOLAR ABSORPTION OF ZINC OXIDE, SELENIUM AND SILICON CARBIDE. R.Freymann.
Semiconductors and phosphors. See Abstr. 9597. pp. 554-7.
In French.

Measurements were made of the dark dielectric absorption of various ZnO specimens at temperatures from 20-130° K, and frequencies of 1 to 1000 Mc/s, and various activation energies were derived. Some results on the effect of infrared irradiation on the dielectric absorption of selenium are reported. J.B.Birks

537.226.31

10954. PHOTODIPOLAR ABSORPTION OF ZINC SULPHIDE. R.Freymann and E.Grillot.
Semiconductors and phosphors. See Abstr. 9597. pp. 557-9.

The dielectric losses of various ZnS preparations, when excited by 3650 A irradiation, were measured from 100 c/s to 1 Mc/s at temperatures from 80° to 300° K. Absorption bands are observed due to dipoles induced by the irradiation, and the activation energies determined agree well with those obtained from thermoluminescence studies. The growth and decay of the dielectric absorption were observed at various frequencies and temperatures. J.B.Birks

537.226.31

10955. DIELECTRIC CONSTANT, DIELECTRIC LOSSES AND ELECTRIC CONDUCTIVITY OF ALKALI HALIDE MONOCRYSTALS. B.N.Matsonashvili.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 3, 296-308 (1958). In Russian.

Main purpose of the investigation was to clarify the character of the dielectric losses of pure and mixed crystals, particularly factors affecting the relaxation losses. The temperature and frequency relations of the relaxation maxima were obtained in wide temperature and frequency ranges. Dielectric losses were measured and conductivity obtained for the same specimens, since hygroscopicity of crystals was found to vitiate measurements in air. Electrical Research Association

537.311.31 : 539.2

EFFECT OF UMKLAPP PROCESSES ON THE ELECTRICAL RESISTANCE OF METALS AT LOW TEMPERATURE. See Abstr. 10265

537.226.32 : 771.531

10956. PRODUCTION OF PICTURES ON THE SURFACE OF PHOTOELECTRETS. I.S.Zheludev and V.M.Fridkin.
C.R. Acad. Bulg. Sci., Vol. 10, No. 2, 109-12 (March-April, 1957). In Russian.

See Abstr. 3037 (1938). A thin S layer, deposited in vacuo on the surface of an Al or Zn strip, was polarized at continuous illumination and with an applied potential. The semi-transparent electrode was a quartz plate with a deposited Au or Ag layer. After complete polarization the illumination and potential were discontinued. The charge (or field intensity) of the photoelectret obtained could be measured with a dynamical electrometer (wiring diagram given). An arbitrary diapositive was placed on the photoelectret surface, and a second illumination was carried out, the result being a latent image; this was developed using the triboelectric effect (a mixture of asphalt powder with fine sand or NaCl powder was poured on the exposed surface). To transfer the picture from the photoelectret on to paper the latter was applied to the former, and both were placed in the corona-discharge field. The fixation consisted in fusing the transferred asphalt particles. F.Lachman

ELECTRIC CONDUCTION
SEMICONDUCTORS

537.3

10957. SUGGESTED MODIFICATIONS TO A METHOD FOR THE DETERMINATION OF THE ABSOLUTE AMPERE. M.Romanowski and R.Bailey.
Canad. J. Phys., Vol. 37, No. 7, 896-8 (July, 1959).

The only alternative method to that of the current balance is the Briggs' freely suspended coil and rotating search coil method (Abstr. 2344 of 1936). It is suggested that by substituting a homopolar generator for the search coil sufficiently higher accuracy may be obtained for the second operation for an independent check of the balance method. S.Weintroub

537.311 : 550.837.3

10958. AN IMAGE ANALYSIS OF MULTIPLE-LAYER RESISTIVITY PROBLEMS. I.Roman.
Geophysics, Vol. 24, No. 3, 485-509 (July, 1959).

The Kelvin method of images is expressible by a transflection at a boundary. The original source is augmented by a supplement and a complement. The supplement contributes to the potential on the same side of the boundary as the source, but it lies at the optical image position of the source in the boundary. The complement lies at the position of the source but contributes to the potential on the opposite side of the boundary. For two or more boundaries, there are two exterior regions and one or more interior regions. For a source in the top layer, a primary sequence starts with a downward transflection and a secondary sequence with an upward transflection. To each primary sequence of transflections there corresponds a secondary sequence with an upward transflection at the upper boundary ahead of it. The exterior images are not transflected again. Successive transflections occur at adjacent boundaries, suggesting a link of two transflections. To a sequence of links, called a chain, there corresponds an associated sequence, obtained by dropping the last transflection. Exterior images follow from interior, associated from chain, and secondary from primary. Thus, only primary, interior, chain images need to be traced. Each potential is the sum of terms of the form m/r, where m is the strength of a specific image, r is the distance of that image from the test point, and the sum includes all images contributing to that potential. The addition to each boundary introduces images and potentials that must be added to those existing prior to the introduction, but it does not otherwise alter them. For the three-boundary problem, the separate image strengths are determined by simple multiplication after a kernel polynomial is calculated. The latter is a finite polynomial in the reflection-factor at the middle boundary and can be tabulated. For the images of a specific potential and depth group, the strengths satisfy a recursion formula that serves as a check on direct evaluations.

537.311.3

10959. MEASUREMENT OF ELECTRICAL RESISTIVITIES OF CONDUCTORS BY THE BALLISTIC METHOD.
K.D.Baveja and J.S.Dhillon.
J. sci. industr. Res., Vol. 17B, No. 10, 394-6 (Oct., 1958).

The ballistic method for conductors in the form of annular rings has been extended to specimens in the form of disks. The results of resistivity measurements carried out at room temperature for the ring and disk specimens have been found to agree well.

537.311.31 : 539.2

10960. THE INFLUENCE OF LATTICE DEFECTS ON THE ELECTRICAL RESISTIVITY OF A GOLD–COPPER ALLOY (7 at. % Cu).
B.M.Korevaar.
Acta metallurgica, Vol. 6, No. 9, 572-9 (Sept., 1958).

Lattice defects were introduced in wires by quenching from 900°C or 450°C, or by stretching 15 per cent at −195°C. The effect of annealing at temperatures up to 300°C on the electrical resistivity was investigated. For comparison the same experiments were carried out on pure gold. In the annealed state short range order exists in the alloy, which causes an increase in the resistivity at −195°C of about 3 per cent. This order is destroyed both by heating and quenching, and stretching the material; it may be restored by annealing between −40° and +200°C, by means of a diffusion of lattice defects with an activation of 0.60 ± 0.05 eV. From the initial velocities of ordering on annealing after quenching from 900°C and from 450°C, the energy of formation of these defects is found to be 0.93 ± 0.10 eV. After quenching only one recovery step is found; after stretching three different recovery steps may be distinguished. In the first of these steps, between −195°C and −40°C with activation energy 0.3-0.4 eV, no ordering takes place. This gives an argument against the attribution of this step to double vacancies. The second step (between −40° and +100°C) shows the same recovery mechanism as is found after quenching. In the third step, which was not fully investigated, recrystallization takes place.

537.311.31 : 541.183.5

10961. CHANGES OF ELECTRIC RESISTANCE OF [ANNEALED] NICKEL FILMS WITH ADSORPTION OF HYDROGEN.
Z.Oda and H.Arata.
J. phys. Chem., Vol. 62, No. 12, 1471-4 (Dec., 1958).

Investigated by changing the condition of preparation. The resistance increases on very clean films, while it decreases on contaminated films. Experiments show that this decrease is due not to the oxygen adsorbed on the surface, but to that which has diffused into the nickel lattice. There are two sorts of reversal in resistance change during adsorption, one occurs on a very clean film at −183°C and the other on a film containing a small amount of oxygen at 0°C. The former is considered to be an inherent property of nickel film, while the latter is a spurious one due to oxygen. The degree of vacuum which can guarantee the cleanliness of the film is discussed.

537.311.31 : 536.212.2

10962. TRANSPORT PHENOMENA IN MONOVALENT METALS.
M.Tsuji.
J. Phys. Soc. Japan, Vol. 13, No. 4, 426 (April, 1958).

The paper gives an outline of a calculation of the electrical and thermal conductivities and the absolute thermal power of a monovalent metal, using a spherical band electron model and a Debye model for the phonons. The formulae given are valid for all temperatures and for any impurity concentration. M.G.Priestley

537.311.31

10963. ELECTRICAL RESISTANCE OF SOME NOBLE-METAL ALLOYS AT LIQUID-HELIUM TEMPERATURES. N.Bäcklund.
J. Phys. Chem. Solids, Vol. 7, No. 1, 94-5 (Oct., 1958).

The resistivity of various alloys, each having a noble metal base was measured in the temperature range from 1.2° to 4.2°K. P.M.Davidson

537.311.31

10964. ELECTRICAL CONDUCTIVITY OF METALS AT LOW TEMPERATURES. L.Supek.
Nuovo Cimento, Vol. 12, No. 3, 290-2 (May 1, 1959).

An extension of the theory previously developed (Abstr. 4951 of 1958) to include the effect of phonon unbalance. R.G.Chambers

537.311.32

10965. THE DEPENDENCE OF THE SPECIFIC RESISTANCE OF FERRITES ON PRESSURE.
H.Henniger, H.Hultschig and G.Heratsch.
Exper. Tech. der Phys., Vol. 7, No. 2, 90-1 (1959). In German.

Reports results of resistance measurements on Ni–Zn ferrite powders as dependent on the degree of compression. E.P.Wohlfarth

537.311.32

10966. ELECTRICAL PROPERTIES OF SYNTHETIC METALLIFEROUS ORE.
R.B.McEuen, J.W.Berg, Jr and K.L.Cook.
Geophysics, Vol. 24, No. 3, 510-30 (July, 1959).

Ninety small cores of synthetic metalliferous ore were constructed from solid glass spheres averaging 0.5 mm in diameter, lead spheres 1.0 mm in diameter, and refractory cement. The lead content of the cores varied from zero to 50 percent by frame volume. The effective porosity was controlled by the manufacturing pressure and ranged from 10 to 20 percent. The cores were saturated with NaCl solution. The apparent impedance of the cores was measured with a modified Wheatstone bridge as a function of frequency and current density. The low-frequency effects of induced polarization were separated from the over-all decrease of impedance with increase of frequency by taking advantage of the dependence of these effects upon current density. The over-all decrease of the impedance with frequency and the polarization effects were found dependent upon the effective porosity and the lead content. Both the polarization effects and the over-all decrease of the impedance with frequency increased with decreasing porosity. The induced polarization effects at 10 c/s attained a maximum at approximately 15 percent lead content. The impedance of a synthetic ore with a small lead content was found to be larger than that of corresponding cores barren of lead.

537.311.32

10967. CONDUCTIVITY MEASUREMENTS ON AgCl CRYSTALS.
E.Jeltsch.
Z. Phys., Vol. 154, No. 5, 601-12 (1959). In German.

Measurements of electrical conductivity were made at low temperatures on pure crystals of AgCl and on crystals containing

Ag_2S or Ag_2Se, irradiated by light or X-rays. The results are interpreted in terms of electron traps with binding energies between 10^{-3} and 10^{-2} eV. J.Thewlis

537.311.33

10968. THE FIRST ALL-UNION CONFERENCE ON PHOTOELECTRICAL AND OPTICAL PHENOMENA IN SEMICONDUCTORS. É.I.Rashba, O.V.Snitko and K.B.Tolpygo.
Zh. tekh. Fiz., Vol. 28, No. 12, 2696-706 (1958). In Russian.

A brief summary of each of the 65 papers presented at the conference held in Kiev, November 20-26, 1957, is given together with the main points raised during the discussion. The following subjects were dealt with: photoconductivity of semiconductors; optical properties of semiconductors; photoelectromotive forces in semiconductors; semiconductive photoelements and photoresistors; complex semiconductor systems; recombination processes and light absorption in Ge-type semiconductors; the effect of hard and corpuscular radiations on semiconductors; the properties of thin, semiconductive films. M.H.Sloboda

537.311.33

10969. THE INTERACTION OF ELECTRONS AND PHONONS IN SEMICONDUCTOR TRANSPORT PHENOMENA. J.E.Parrott.
Semiconductors and phosphors. See Abstr. 9597. pp. 495-6.

It is found that the application of the "electron–phonon drag" analysis to the electrical and thermal conductivity of Ge does not produce such large effects as it does on the thermoelectric properties. J.B.Birks

537.311.33

10970. A NOTE ON THE ENERGY GAPS OF SEMICONDUCTORS. T.Miyauchi.
Semiconductors and phosphors. See Abstr. 9597. pp. 650-1.

The energy gaps of a number of elementary and binary compound semiconductors are plotted against the "relative distance" of the atoms (defined as "the ratio of the distance between the neighbouring elements to the sum of the ion radii of the elements"). The data fall approximately on 3 straight lines, with a few deviations, which are discussed. The method is suggested as suitable for the prediction of unknown or uncertain energy gaps. J.B.Birks

537.311.33

10971. SOME PROBLEMS IN THE THEORY OF SEMICONDUCTORS WITH A NARROW IMPURITY ZONE. V.M.Nitsovich.
Fiz. Metallov i Metallovedenie, Vol. 6, No. 1, 23-39 (1958). In Russian.

The author discusses: (1) the variation of degeneracy of the electrons in a narrow impurity band with temperature and fullness of the band; (2) the conditions under which effective mass theory is applicable to these electrons; (3) the density of electron states in impurity bands in body-centred and simple cubic lattices. The electrical conductivity (σ) of the narrow band is shown to vary as T^{-1} at low temperatures and as T^{-2} at high temperatures. In the top half of the narrow band σ is p-type, in the bottom half n-type. Maximum σ at all temperatures corresponds to a half-full band. If account is taken of transitions between the impurity band and the conduction band $\sigma \propto T^{-3/2}$. There are 14 references. A.F.Brown

537.311.33 : 539.37

10972. THE EFFECTS OF ELASTIC STRAIN ON THE CONDUCTIVITY OF HOMOPOLAR SEMICONDUCTORS. R.W.Keyes.
Semiconductors and phosphors. See Abstr. 9597. pp. 236-46.

The paper discusses the effects of two general types of elastic strain (a) due to hydrostatic pressure, and (b) due to homogeneous shear, on the electrical conductivity of semiconductors with emphasis on qualitative aspects of the phenomena. Data on Te, Ge, Si, P, InSb, InAs and Mg_2Sn are compiled, and the results on Ge and InSb are discussed in more detail. There are 42 references. J.B.Birks

537.311.33

10973. ON THE THEORY OF ELECTRON MOBILITY IN SEMICONDUCTORS. I.I.Boiko.
Fiz. tverdogo Tela., Vol. 1, No. 4, 574-8 (April, 1959). In Russian.

The Coulomb scattering of electrons by a centre in an anisotropic medium is considered using the Born approximation. The mobility is calculated for the case of ellipsoidal isoenergetic surfaces, and the results compared with the theoretical formula of Conwell and Weisskopf. K.N.R.Taylor

537.311.33

10974. NOISE THEORY FOR HOT ELECTRONS. P.J.Price.
I.B.M. J. Res. Developm., Vol. 3, No. 2, 191-3 (April, 1959).

The relationship between the Wiener–Khinchin relations and the Einstein mobility relation is discussed for the case of hot electrons. P.T.Landsberg

537.311.33

10975. DRIFT OF MINORITY CARRIERS IN THE PRESENCE OF TRAPPING. A.K.Jonscher.
Semiconductors and phosphors. See Abstr. 9597. pp. 402-7.

A model of a p-type semiconductor with a single trapping level is used to treat the drift of free minority carriers. The spatial distributions of the excess free carrier density and the trapped carrier density for moderate and relatively heavy trapping are calculated. J.B.Birks

537.311.33

10976. MEASUREMENT OF MINORITY CARRIER LIFETIME BY THE PHASE SHIFT OF PHOTOCONDUCTIVITY. M.S.Ridout.
Semiconductors and phosphors. See Abstr. 9597. pp. 408-12.

The theory and experimental details are given of a method of measuring minority carrier lifetime in semiconductors by observing the phase lag between the photo-conductivity and the sinusoidal light source initiating it. J.B.Birks

537.311.33

10977. THE CARRIER TRAPPING DUE TO THE DISLOCATIONS IN POLAR AND NONPOLAR SEMICONDUCTORS. H.Kawamura, J.Okada, H.Okura and Y.Uemura.
Semiconductors and phosphors. See Abstr. 9597. pp. 400-1.

The effect of dislocations on the range or lifetime of carriers was studied for the typical non-polar crystal Ge and for the polar KBr. Values of the effective width of a dislocation for trapping of 2.9 A for Ge, and of 30 A for KBr are obtained, compared with theoretical calculations of $\cong$ 0.1 A for Ge and 1-10 A for NaCl. J.B.Birks

537.311.33 : 539.21

10978. RECOMBINATION PROPERTIES OF BOMBARDMENT DEFECTS IN SEMICONDUCTORS. G.K.Wertheim.
J. appl. Phys., Vol. 30, No. 8, 1166-74 (Aug., 1959).

The theory of recombination via defects having energy levels in the forbidden gap is reviewed. Emphasis is given to those aspects which complicate interpretation of lifetime data, such as the inherent difference between steady state and transient measurements, large-signal behaviour, competing recombination mechanisms, trapping, the possible existence of strongly temperature-dependent cross-sections, and the properties of multilevel defects. A summary of the known recombination properties of bombardment-produced defects is given.

537.311.33 : 539.21

10979. RADIATION EFFECTS IN SEMICONDUCTORS: THERMAL CONDUCTIVITY AND THERMOELECTRIC POWER. T.H.Geballe.
J. appl. Phys., Vol. 30, No. 8, 1153-7 (Aug., 1959).

The use of thermal conduction and thermoelectric measurements in studying radiation damage effects in semiconductors is discussed. The conclusion is reached that in the present state of knowledge such measurements will probably be more helpful in studying the kinetics of the formation and annealing of radiation-introduced defects than in characterizing the structure of such defects.

537.311.33 : 539.21

10980. RADIATION-PRODUCED ENERGY LEVELS IN COMPOUND SEMICONDUCTORS. L.W.Aukerman.
J. appl. Phys., Vol. 30, No. 8, 1239-43 (Aug., 1959).

The effects of high-energy radiation on the electrical properties of compound semiconductors are reviewed. Emphasis is placed on those effects which can be interpreted in terms of energy levels. The following compounds are discussed: InSb, InAs, GaSb, AlSb, GaAs, InP, CdTe, and SiC. The implications of bombardment-produced changes in carrier concentration on possible energy levels are considered. Of the compound semiconductors, only InSb, irradiated at 200°K with electrons, has been sufficiently studied to enable a determination of the positions of the energy levels and their rates of generation. The annealing behaviour of both InSb and GaSb is complex. A possible interpretation of these annealing characteristics in terms of shifting energy levels is discussed.

537.311.33 : 539.21

ANNEALING OF RADIATION DEFECTS IN SEMICONDUCTORS. See Abstr. 10277

537.311.33

10981. DISPLACEMENT THRESHOLDS IN SEMICONDUCTORS. J.J.Loferski and P.Rappaport.
J. appl. Phys., Vol. 30, No. 8, 1296-9 (Aug., 1959).

The paper reviews the current status of displacement threshold determinations, both theoretical and experimental, in semiconductors. The work of numerous authors on germanium are discussed and compared. Measurements of thresholds in Si and InSb also are discussed briefly.

537.311.33

10982. ON THE ELECTRICAL CONDUCTIVITY OF OXIDES. W.Noddack and H.Walch.
Z. Elektrochem., Vol. 63, No. 2, 269-74 (1959). In German.

The electrical conductivity of the rare earth oxides of purity 99.92% to 99.98% has been found to be, at 873°K, an electron transport phenomenon. The test-pieces were compressed cylinders, which had been sintered at 1300°C for 3 to 6 hr. The temperature dependence of the electrical conductivity shows that the rare earth oxides are semiconductors. There appears to be a difference in the behaviour of mixtures of trivalent as against mixtures of tri- and tetravalent oxides. Small additions (0.01%-0.1%) of one trivalent oxide to another do not appreciably alter its conductivity, whereas mixtures of tri- and tetravalent oxides show higher conductivity than the components. R.Schnurmann

537.311.33 : 537.533 : 621.385.032.213.13

NOTE ON THE ROLE OF COLLOIDAL PARTICLES IN THE ELECTRO-CONDUCTION AND THERMO-EMISSION OF SEMICONDUCTOR CATHODES. See Abstr. 9688

537.311.33 : 538.2

MAGNETIC SUSCEPTIBILITY OF SEMICONDUCTORS. See Abstr. 9761

537.311.33 : 539.219

PRECIPITATION IN SEMICONDUCTORS. See Abstr. 10294

537.311.33 : 530.162

SOME STATISTICAL PROBLEMS IN SEMICONDUCTORS. See Abstr. 10635

537.311.33

10983. HOLE MOTION IN ANTHRACENE CRYSTALS. H.Kallmann and M.Silver.
Semiconductors and phosphors. See Abstr. 9597. pp. 435-8.

Flat transparent layers of anthracene between two conducting glass electrodes are polarized by ultra-violet excitation, and the polarization is determined after various periods. It is found that the polarization rate is vastly different depending on whether the excited layer is adjacent to the positive or negative electrode. The results confirm the previous conclusion that the positive carriers (holes) in anthracene crystals are the more mobile. J.B.Birks

537.311.33

10984. RATIO OF RANGES OF FREE CARRIERS IN ANTHRACENE SURFACE CELL. K.Pigon and H.Chojnacki.
J. chem. Phys., Vol. 31, No. 1, 272-3 (July, 1959).

From a light spot experiment the ratio of the ranges of holes to electrons was found to be 2.13 ± 0.45. This result can be converted to a mobility ratio only if the lifetimes are assumed equal. The importance of keeping the spot width much less than the distance between electrodes is noted. D.J.Oliver

537.311.33

10985. SOME PHYSICAL PROPERTIES OF BISMUTH TELLURIDE. D.A.Wright.
Semiconductors and phosphors. See Abstr. 9597. pp. 477-81.

This paper summarizes information on the crystal structure, preparation, electrical and thermal conductivity, Hall effect, thermoelectric power and band structure of Bi_2Te_3. J.B.Birks

537.311.33

10986. ON THE ELECTRICAL PROPERTIES OF POLYCRYSTALLINE BORON. R.Uno.
J. Phys. Soc. Japan, Vol. 13, No. 7, 667-75 (July, 1958).

Several specimens of polycrystalline boron, which have various electrical conductivities at room temperature, ranging from 8 to 5×10^{-3} ohm^{-1} cm^{-1} or less, were obtained by reduction of distilled boron tribromide. Spectroscopic analysis and observation by the Debye–Scherrer X-ray pattern were carried out. Some evidence was obtained showing that the conductivity at room temperature may not increase with the amount of impurities but depends rather on the difference in the crystal structure. Assuming a simple model, carrier concentration and mobility were estimated from the data of conductivity and thermoelectric power. The result was that the carrier concentration may be nearly constant over the range from 100° to 1000°K and that the mobility may vary exponentially with the reciprocal of absolute temperature.

537.311.33

10987. MAGNETORESISTANCE AND HALL EFFECT STUDIES IN GRAPHITE. R.G.Breckenridge.
Semiconductors and phosphors. See Abstr. 9597. pp. 456-62.

The magnetoresistance and Hall coefficient of a purified natural single crystal of graphite were measured at temperatures of 300°, 77°, and 4.2°K, and magnetic fields from 16 to 25 000 gauss. The Hall coefficient is negative at large fields but becomes positive at small fields indicating the existence of several types of charge carriers. Oscillations, analogous to the de Haas–van Alphen effect, occur in both quantities with identical periods. A theoretical analysi of the data is discussed. J.B.Birks

537.311.33

10988. ON THE GRAPHITIZATION OF CARBON. II. HALL EFFECT AND ELECTRICAL CONDUCTIVITY. O.Hauser.
Z. phys. Chem. (Leipzig), Vol. 210, No. 3-4, 151-65 (March, 1959). In German.

For Pt I, see Z. phys. Chem. (Leipzig), Vol. 209, No. 5-6, 352 (Oct., 1958). The graphitization of two types of carbon black and of petroleum coke was carried out at temperatures between 1300° and 3000°C, and conductivity and Hall coefficient were measured on the resultant samples. The results are interpreted in terms of the known differences in crystal perfection of the different types of carbon, and an attempt is made to explain the conduction mechanism in graphite in terms of semiconductor theory. K.W.Plessner

537.311.33

10989. THE PROBLEM OF MEASURING THE HOLE DIFFUSION LENGTH IN CADMIUM SULPHIDE. N.A.Vitovskii and P.I.Maleev.
Fiz. tverdogo Tela, Vol. 1, No. 6, 984-5 (June, 1959). In Russian.

Describes a method of determining the hole diffusion length L_p in monocrystalline CdS (50-100 μ thick) from the relationship of the amplitude of pulses excited by α-particles to the voltage on the crystal. The α-radiation is carried via one of two thin (about 1 μ) indium electrodes bearing against the crystal walls. Values obtained for L_p on three samples are 1.5 μ, 3.2 μ, 1.3 μ, in good agreement with the figures obtained by other methods. D.E.Brown

537.311.33 : 539.21

10990. CONDUCTIVITY INDUCED BY RADIATION IN POLYCRYSTALLINE CADMIUM SULPHIDE AND POLYETHYLENE. C.G.Clayton, B.C.Haywood and J.F.Fowler.
Nature (London), Vol. 183, 1112-13 (April 18, 1959).

When the source of radiation was removed an initial rapid non-hyperbolic drop of current was observed. This indicates that the rate of release of electrons from traps is smaller than the rate of recombination. J.Adam

537.311.33

10991. FIELD EFFECT IN CdS SINGLE CRYSTALS. W.Thielemann.
Z. Naturforsch., Vol. 14a, No. 1, 92-3 (Jan., 1959). In German.

An increase in the density of conduction electrons arising from a capacitively applied electric field, in a similar experiment to that attempted for Ge by Pearson and Shockley, is observed. C.A.Hogarth

537.311.33 : 535.37

CONDUCTIVITY OF ELECTRON-IRRADIATED CdS. See Abstr. 10848

537.311.33

10992. MAGNETORESISTANCE EFFECTS IN GALLIUM ARSENIDE. R.Broom, R.Barrie and I.M.Ross.
Semiconductors and phosphors. See Abstr. 9597. pp. 453-6.

The Hall constant and resistivity of n-type single crystals of GaAs have been studied as a function of temperature from 1.6°K to 360°K and of magnetic field strengths up to 10 000 Oe. J.B.Birks

537.311.33

10993. ELECTRICAL PROPERTIES OF GALLIUM ARSENO-SELENIDES. D.N.Nasledov and I.A.Feltinsh'.
Fiz. tverdogo Tela, Vol. 1, No. 4, 565-7 (April, 1959). In Russian.

GaAs–Ga_2Se_3 samples of various compositions were studied.

The electrical conductivity (σ) rose to a maximum ($\sim 1000\ \text{ohm}^{-1}\text{cm}^{-1}$) at ~ 95 mol.% of GaAs and the thermoelectric power (α) had a minimum (~ 50 μV/deg) at the same composition. With increase of the amount of Ga_2Se_3, the conductivity fell monotonically but the thermoelectric power rose to a maximum (700 μV/deg) at ~ 80% of GaAs, and then fell monotonically, changing sign at ~ 35% of GaAs. This change of sign was due to a transition from the n-type conductivity of GaAs to p-type conductivity of Ga_2Se_3. The electrical conductivity of GaAs–Ga_2Se_3 samples with 90-100 mol.% of GaAs was practically independent of temperature between 90° and 570°K (metallic conduction), but in samples with smaller amounts of GaAs $\log\sigma$ varied exponentially with 1/T, where T is the absolute temperature.

A.Tybulewicz

537.311,33

10994. THE GALVANOMAGNETIC EFFECTS IN THE GERMANIUM–SILICON ALLOYS. M.Glicksman.
Semiconductors and phosphors. See Abstr. 9597. p.452.

Measurements of the Hall effect and magnetoresistance in n-type Ge–Si alloys reveal a change in the electronic band structure with alloy composition, indicating a change from the Ge-type conduction band to the Si-type band at about 15% Si in Ge. J.B.Birks

537.311.33 : 621.372.837.2 : 621.315.59

10995. MICROWAVE INDUCED CARRIER MULTIPLICATION IN GERMANIUM. K.Seeger.
J. appl. Phys., Vol. 30, No. 3, 443-4 (March, 1959).

Carrier multiplication and non-destructive breakdown were studied by measuring the power transmitted through a length of 8 mm waveguide filled with a block of Ge at 4.5°K. For incident powers less than 100 mW, about 10% of the incident power was transmitted; at higher incident powers up to 1 kW the transmitted power saturated at about 30 mW. It is suggested that the arrangement might be used as a TR switch. R.G.Chambers

537.311.33

10996. FREE-CARRIER FARADAY EFFECT IN N-TYPE GERMANIUM. A.K.Walton and T.S.Moss.
J. appl. Phys., Vol. 30, No. 6, 951-2 (June, 1959).

The rotation θ of a beam of polarized infrared radiation was measured at different wavelengths. The results, by showing $\theta \propto \lambda^2$, provide experimental evidence for the theory developed by Lidiard and Stephens for the rotation due to free carriers when the energy surfaces are ellipsoidal. A departure from the λ^2 dependence of θ near the absorption edge is accounted for as a band-to-band contribution to the rotation, and the slope of the straight line part is used to determine m* of the free carriers in the material. The value of $m^* = (0.135 \pm 0.004)m_0$ compares well with a cyclotron resonance value. This technique could be used to determine the carrier concentration in highly impure specimens or at low temperatures. I.Cooke

537.311.33

10997. ANISTROPY OF HOT ELECTRONS IN N-TYPE GERMANIUM. W.Sasaki, M.Shibuya and K.Mizuguchi.
J. Phys. Soc. Japan, Vol. 13, No. 5, 456-60 (May, 1958).

Electromotive force perpendicular to the current flowing in n-type germanium samples is observed. The deviation angle of the electric field vector from the current vector is a function of current orientation, temperature, and field strength, and in some cases exceeds 20°. This effect can be attributed to the anistropy in electric conduction due to the ellipsoidal energy surfaces.

537.311.33

10998. RECOMBINATION CENTERS IN GERMANIUM. J.Okada.
J. Phys. Soc. Japan, Vol. 13, No. 8, 793-800 (Aug., 1958).

The dependence of carrier lifetime in pure germanium upon injection level has been studied using a photoconductive decay method. The data are analysed in terms of the recombination theory for transient conditions, including the case of high injection level. The results show that at least two recombination levels exist in pure germanium: one is active in n-type and the other in p-type. The recombination level in n-type germanium is at 0.28 eV from the conduction band, and the cross-section for the capture of holes A_p is about 4.7 times larger than that for the capture of electrons A_n. The recombination level in p-type germanium is at 0.25 eV from the valence band, or 0.31 eV from the conduction band, and A_n/A_p is about 9.8.

537.311.33

10999. CALCULATION OF THE INFLUENCE OF ANISOTROPY AND AN ADDITIONAL MAGNETIC FIELD ON THE ELECTRICAL BREAKDOWN WITH APPLICATION TO GERMANIUM. W.Frie.
Z. Naturforsch., Vol. 14a, No. 1, 54-62 (Jan., 1959). In German.

Franz's [Encylopedia of Physics, Volume 17. Berlin/Gottingen/Heidelberg: Springer-Verlag (1956) pp. 155-263] theory of avalanche breakdown is extended and it is shown that a magnetic field, applied in any direction, increases the breakdown field except that there is no effect when the magnetic field is parallel to the current in an isotropic semiconductor. Detailed results are presented for germanium and are compared with existing measurements.

R.Stratton

537.311.33

11000. THE BEHAVIOUR OF SINGLE CRYSTALS OF N-TYPE GERMANIUM IN THE TEMPERATURE RANGE OF LIQUID HELIUM. G.Finke and G.Lautz.
Z. Naturforsch., Vol. 14a, No. 1, 62-74 (Jan., 1959). In German.

Experiments were carried out to test theoretical ideas on the transition from the normal conducting mechanism to impurity band conduction. The electrical field dependence of the electrical resistivity and Hall constants was measured in the range of normal conduction and interpreted assuming charge-carrier multiplication by ionic collisions. In the region of impurity band conduction, the experimental results on the field strength dependence of the resistivity and Hall constants are explained using a new mechanism of "ionization" of electrons in the impurity. B.T.M.Willis

537.311.33

11001. INVESTIGATION OF THE ENERGY STATES AND THE EFFECTIVE CAPTURE CROSS-SECTIONS OF THE SURFACE RECOMBINATION LEVELS IN GERMANIUM.
A.V.Rzhanov, N.M.Pavlov and M.A.Selezneva.
Zh. tekh. Fiz., Vol. 28, No. 12, 2645-56 (1958). In Russian.

Surface recombination velocity and the field effect in a p-type, 25 cm Ge filament were measured at 280, 300, and 319°K, in various ambient atmospheres. From the experimental data, the temperature dependence of the energy states and the effect capture cross-sections for holes and electrons, and the dependence of these characteristics on the amplitude of the transverse electric field, were tentatively determined. The fact that for increasing concentration of the recombination levels their energy state monotonically increased is attributed to the effect of the charge captured on the "slow" surface levels on the characteristics of the surface recombination levels, from which it is concluded that the nature of the surface recombination levels appearing on Ge specimens heated in vacuum or subjected to the action of ozone is the same.

M.H.Sloboda

537.311.33

11002. THE GERMANIUM ELECTRODE WITH A P–N JUNCTION. E.A.Efimov and I.G.Erusalimchik.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 4, 632-4 (1958). In Russian.

Injection or extraction of holes across a p–n junction situated close to the surface of a n-type electrode is shown to affect the polarization characteristic in a manner consistent with a mechanism for anodic solution determined by the availability of holes at the electrode–electrolyte interface. (See also Abstr. 4650 of 1955).

C.H.L.Goodman

537.311.33

11003. ON THE BACKWARD LEAKAGE CURRENT IN THE ALLOYED GERMANIUM P–N JUNCTION. M.Kikuchi.
J. Phys. Soc. Japan, Vol. 13, No. 4, 350-62 (April, 1958).

It has been observed that the "creep" phenomenon often found in the backward direction of the alloyed germanium p–n junction occurred in the so-called "leakage current component". It has also been found that in some of the alloyed junction transistor samples, the characteristics of the collector junction was influenced by the creep in the emitter junction. The experimental procedures and results are described. Although there is no complete theory to explain these experimental observations, some essential remarks are given from theoretical considerations. In the last section, an experimental result which might be evidence for the correlation between the creep phenomenon and the surface field effect is given.

537.311.33 : 539.21

11004. IRRADIATION OF SEMICONDUCTORS.
H.Y.Fan and K.Lark-Horovitz.
Semiconductors and phosphors. See Abstr. 9597. pp. 113-38.

Ge specimens of various resistivities and carrier concentrations have been irradiated with deuterons, α-particles and electrons.

Energy levels introduced by defects are determined from the removal rate of carriers, the temperature dependence of the Hall coefficient, and the photoconductivity spectral response. The data lead to a model of the defects, with interstitials as donors, vacancies as acceptors, and each defect introducing several levels. At room temperature the distribution of introduced energy levels is more smeared out for α-irradiation than for electrons. Energy level redistribution effects are observed at 90°K; at 150° and 273°K post-irradiation annealing effects are observed. p-type specimens anneal more rapidly than n-type. The mobility decreases during irradiation, indicating the presence of multiply-charged centres. n-type InSb irradiated with electrons at liquid N_2 temperature converts to p-type, while under the same conditions p-type InAs converts to n-type. The prolonged irradiation of Si with neutrons, electrons or deuterons indicates that both n-type and p-type are converted to intrinsic material. Large annealing effects are observed in irradiated Si only at elevated temperatures, indicating that levels are introduced near the top and bottom of the energy gap.

J.B.Birks

537.311.33

11005. ELECTRON BOMBARDMENT INDUCED CONDUCTIVITY IN Ge. A.Zaręba.
Bull. Acad. Polon Sci. Ser. Sci. math. astron. phys., Vol. 7, No. 4, 255-60 (1959).

Experiments were carried out on single crystal germanium by using a modified electron microscope. A theory is given showing how two quantities of interest can be obtained, viz. ϵ the average effective energy needed to generate a hole—electron pair and τ the lifetime of the carriers generated. For an n-type Ge crystal ($\rho = 4\,\Omega$ cm) ϵ was 2.8 ± 0.3 eV and τ was 1.8 ± 0.2 μsec.

D.J.Oliver

537.311.33 : 539.21

11006. RADIATION EFFECTS ON RECOMBINATION IN GERMANIUM. O.L.Curtis, Jr.
J. appl. Phys., Vol. 30, No. 8, 1174-80 (Aug., 1959).

The properties of recombination centres in germanium are obtained on the basis of lifetime data in conjunction with other information available. For recombination centres introduced by Co^{60} gamma-rays and fission neutrons, the recombination energy level position is placed at 0.20 eV below the conduction band. The room temperature hole-capture cross-sections resulting are 1.1×10^{-15} cm^2 and 6×10^{-15} cm^2 for Co^{60} gamma-ray and fission neutron irradiation, respectively. For the case of 14 MeV neutron irradiation the energy level is located 0.32 eV above the valence band. The room temperature hole and electron cross-sections are $\sim 6 \times 10^{-15}$ cm^2 and 2.2×10^{-17} cm^2, respectively. The capture probabilities are assumed to be independent of temperature except for the case of gamma irradiation, for which there is apparently a fairly strong variation corresponding to a change in the activation energy of 0.07 eV. The selection of the values given above is not entirely unique. The assumptions made in their determination are discussed. The values given are directly applicable only in the case of n-type material, the situation in p-type material being more complex.

537.311.33 : 539.21

11007. ELECTRON-BOMBARDMENT INDUCED RECOMBINATION CENTERS IN GERMANIUM. J.J.Loferski and P.Rappaport.
J. appl. Phys., Vol. 30, No. 8, 1181-3 (Aug., 1959).

The rate of change of minority carrier lifetime in germanium crystals bombarded by 1 MeV electrons was studied experimentally as a function of the initial resistivity of the material. Analysis of the data leads to the conclusion that a single recombination centre controls lifetime in both n- and p-type material, that this level is located at either 0.21 ± 0.005 eV from the conduction band or else at 0.26 ± 0.005 eV from the valence band, and that the ratio of the cross-section for capture of minority holes is 18 times the cross-section for capture of minority electrons. The absolute value of the hole capture cross-section is 4.5×10^{-15} cm^2 if the best available data for the probability of producing a Frenkel defect by a 1 MeV electron is used. This large value is compared to the findings of other authors in similar experiments.

537.311.33 : 539.21

11008. NATURE OF BOMBARDMENT DAMAGE AND ENERGY LEVELS IN SEMICONDUCTORS. J.H.Crawford, Jr and J.W.Cleland.
J. appl. Phys., Vol. 30, No. 8, 1204-13 (Aug., 1959).

The different effects of Co^{60} gamma-ray and fast neutron bombardment on the electrical behaviour of germanium are discussed in terms of different local distributions of lattice defects expected for these two types of radiation. For the first of these, which is expected to introduce randomly distributed pairs of interstitials and vacancies, the state at 0.20 eV below the conduction band has been found to increase the concentration of ionized scattering centr on becoming occupied with conduction electrons. This state has bee ascribed to a mobile interstitial because of its annealing behaviour moderate temperatures. Energy levels in p-type Ge and their annealing behaviour are also discussed. In neutron irradiated n-typ Ge the behaviour of Hall mobility and the apparent energy distribution of defect levels are discussed in terms of a tentative model for the potential distribution around regions of high local lattice disord expected to result from neutron bombardment. This model postulat that the disordered region is p-type and is surrounded by a positive space charge region in the n-type matrix which insulates it from th matrix. This configuration of electrostatic potential around the dis ordered region in effect produces an insulating region whose radius is ~ 10 times that of the disordered region itself. The behaviour o Hall mobility in irradiated n-type specimens is consistent with the predictions of this model.

537.311.33 : 539.2

11009. DISORDERED REGIONS IN SEMICONDUCTORS BOMBARDED BY FAST NEUTRONS. B.R.Gossick.
J. appl. Phys., Vol. 30, No. 8, 1214-18 (Aug., 1959).

The width and depth of the potential wells surrounding disorder regions in neutron irradiated n-type germanium and extrinsic silic are estimated. Numerical examples of well dimensions for a wide range of sample characteristics are presented. Some effects of dis ordered regions, e.g. (a) scattering of conduction electrons, (b) abs orption of holes, and (c) polarizability, are discussed.

537.311.33 : 539.21

11010. HIGH-ENERGY ELECTRON IRRADIATION OF GERMANIUM AND TELLURIUM. V.A.J.van Lint and H.Roth.
J. appl. Phys., Vol. 30, No. 8, 1235-8 (Aug., 1959).

Tellurium samples in which current flowed parallel to the c axis were irradiated at 78°K with 20 MeV electrons. The conductivity increased linearly with a slope of 1.0×10^{-14} (ohm cm)$^{-1}$ per electron/cm^2 up to at least 3×10^{14} electrons/cm^2. Beyond 3×10^{15} electrons/cm^2 the slope was approximately one tenth of the initial value. The reciprocal of the Hall coefficient decreased at first and then increased. Between 1×10^{13} and 5×10^{13} electrons/cm^2, $1/R_H$ increases linearly from 3×10^{-5} to 6.3×10^{-5} C/cm^3. After irradiation, the samples showed no measurable conductivity changes during 14 hr at 78°K. After a day's anneal at 300°K the 78°K conductivity returned to its preirradiation value. N-type germanium was irradiated with 20 MeV electrons at room temperature. Conductivity measurements indicated that the sample became intrinsic and then p-type. However, the detailed dependence of conductivity on radiation dosage did not agree with a calculation based on four energy levels introduced into the gap. Carrier lifetime changes were also observed.

537.311.3

11011. ENERGY, ORIENTATION, AND TEMPERATURE DEPENDENCE OF DEFECT FORMATION IN ELECTRON IRRADIATION OF N-TYPE GERMANIUM. W.L.Brown and W.M.Augustyniak.
J. appl. Phys., Vol. 30, No. 8, 1300-9 (Aug., 1959).

From measurements of change in conductivity with electron irradiation of thin n-type germanium samples at 79°K, a threshold energy for the formation of stable acceptor centres was determine It is found to be 355 ± 5 keV, corresponding to 15.1 eV for the lightest mass germanium isotope at rest. Taking into account the contribution of lattice vibrations to the displacement energy the threshold is ~ 16 eV. An orientation dependence was found in the rate of formation of the centres in agreement with the predictions of Kohn [Phys. Rev., Vol. 94, No. 5, 1409 (June 1, 1954)]. In order of decreasing rate of centre formation the three orientations examined are (111), (110), (100). There is no corresponding orientation dependence in the threshold energy itself. The energy dependence of the rate of acceptor formation suggests the defects are not the closest vacancy-interstitial pairs. A positive temperature dependence of the rate of acceptor formation was found. This effect is largest at lowest electron energies. It is not explicable by lattice vibrations, although they can contribute to the effect between 79°K and room temperature. The apparent threshold changes by ~ 100 b between 21° and 263°K.

537.311.33 : 539.2

11012. IRRADIATION DAMAGE IN GERMANIUM AND SILICON DUE TO ELECTRONS AND GAMMA RAYS. J.H.Cahn.
J. appl. Phys., Vol. 30, No. 8, 1310-16 (Aug., 1959).

The simple model for atomic displacements by electrons of

eitz and Koehler (Solid State Physics, Vol. 2, p. 305. See Abstr. 171 of 1957) is used to calculate the total number of displaced oms in germanium and silicon due to electrons and gamma-rays energies up to 7 MeV. The calculations are compared to eported experiments in the literature. Electron damage at energies elow 1 MeV requires the assumption of threshold energies less an 30 eV, while the higher energy electron damage data are fairly ell explained by a 30 eV threshold. The measured gamma-ray ross-sections for atomic displacements are an order of magnitude naller than the calculated cross-sections, even for a 30 eV reshold both for silicon and germanium.

537.311.33 : 539.17

CONSEQUENCES OF THERMAL NEUTRON CAPTURE IN ILICON AND GERMANIUM. See Abstr. 10130

537.311.33 : 539.21

LOW-TEMPERATURE ANNEALING STUDIES IN Ge. ee Abstr. 10281

537.311.33 : 539.21

ENERGY LEVELS IN IRRADIATED GERMANIUM. ee Abstr. 10278

537.311.33 : 535.345

11013. ELECTRICAL AND OPTICAL PROPERTIES OF GeS. .Yabumoto.
. Phys. Soc. Japan, Vol. 13, No. 6, 559-62 (June, 1958).

High purity germanium monosulphide was prepared and its emiconducting properties were measured. Samples were obtained y the reaction of germanium and sulphur in vacuum at high temp- rature and reducing in ammonium gas to remove germanium isulphide. The dark resistivities of evaporated layers and poly- rystalline blocks of GeS prepared by the above method are 10^{10} ohm m or more. The thermal activation energy for dark current is .74-1.0 eV and about 0.25-0.5 eV, at higher and lower temperature egions, respectively. The absorption edge is found at about 700 mμ om the optical measurements. At room temperature the maximum pectral sensitivity of photoconductivity is observed at the wave- ength of about 700 mμ in vacuum and of about 800 mμ in room air. he sign of the observed thermoelectric power is that of p-type at igh temperature, and its magnitude is about 1 mV/deg.

537.311.33 : 539.234

11014. ON THE MECHANISM OF FORMATION [AND CARRIER MOBILITIES] OF THIN LAYERS OF MERCURY SELENIDE AND TELLURIDE. O.D.Elpat'evskaya.
Zh. tekh. Fiz., Vol. 28, No. 12, 2669-75 (1958). In Russian.

Layers were evaporated on to a heated or cooled support. With he support below −30° C, layers of metallic appearance containing xcess Hg were obtained. In the range 10-80° C, transparent layers ormed which became opaque on heating above 100° C. The trans- arent layers had low mobilities and from the diffuseness of the X-ray diffraction pattern had a crystallite size ~ 10^{-6} cm. Layers btained above 100° C and subsequently annealed had mobilities of p to ~ 4000 cm^2/V sec for HgSe and ~ 6000 cm^2/V sec for HgTe. Heating above ~ 200° C led to deterioration in properties. Layer hicknesses were ~ 1 μ. Alloys in the system HgSe—HgTe were also repared. C.H.L.Goodman

537.311.33

11015. ELECTRICAL PROPERTIES OF THIN LAYERS IN THE YSTEM HgSe—HgTe. O.D.Elpat'evskaya.
Zh. tekh. Fiz., Vol. 28, No. 12, 2676-83 (1958). In Russian.

See also preceding abstract. Electrical conductivity (σ), hermoelectric power (α) and Hall effect were studied in the range 200° to 100° C for layers evaporated on to mica or glass. Layers ich in HgSe showed extremely small variation of σ with tempera- ure, unlike those rich in HgTe. The highest α values were obtained or the latter (~ 120 μV/deg). Mobilities approached those for single rystals, at room temperature, but tended to saturate at low tem- eratures. Comparison was made between this behaviour and that or compressed powders and specimens grown from the melt,to in- estigate the effect of crystal size. Sensitive Hall probes were pre- ared which showed negligible variation of Hall e.m.f. over the range -200° to 80° C. C.H.L.Goodman

537.311.33 : 548.5

PREPARATION AND PROPERTIES OF INDIUM ARSENIDE. ee Abstr. 10358

537.311.33

11016. THE PHOTOMAGNETOELECTRIC EFFECT IN N-TYPE INDIUM ANTIMONIDE SINGLE CRYSTALS.
D.N.Nasledov and Yu.S.Smetannikova.
Fiz. tverdogo Tela, Vol. 1, No. 4, 556-8 (April, 1959). In Russian.

The transverse effect was measured in zone-refined InSb with impurity range 2×10^{13} to 2×10^{14} donors/cm^3. Results at 110° K are reported for H = 300-20 000 Oe, and at 19 000 Oe for T from 110° to 250° K (which includes both intrinsic and impurity conduction). R.Berman

537.311.33

11017. ELECTRICAL PROPERTIES OF P-TYPE InSb AT LOW TEMPERATURES. Lyan' Chzhi-chao and D.N.Nasledov.
Fiz. tverdogo Tela, Vol. 1, No. 4, 570-1 (April, 1959). In Russian.

The temperature dependences of the electrical conductivity and the Hall constant of p-type InSb with 10^{15} and 10^{14} acceptors/cm^3 agreed with those reported earlier (Abstr. 7955 of 1955; 2108 of 1956; 5894 of 1958). In p-InSb with ~10^{13} acceptors per cm^3 the Hall constant rose continuously and the electrical conductivity fell continuously with lowering of temperature from 300° to 4.5° K. The results are discussed briefly. A.Tybulewicz

537.311.33

11018. THE LIFETIME OF CHARGE CARRIERS IN PbS.
W.W.Scanlon.
Semiconductors and phosphors. See Abstr. 9597. p. 399.

A short account of general, lifetime, and etch pit studies of natural and synthetic PbS crystals. J.B.Birks

537.311.33

11019. DETERMINATION OF SURFACE STATES IN PbS CRYSTALS. L.Sosnowski.
Semiconductors and phosphors. See Abstr. 9597. pp. 674-7.

A square-wave technique for applying a transverse electric field to produce the field effect was used to study the surface states of PbS crystals. J.B.Birks

537.311.33

11020. HALL AND CONDUCTIVITY MOBILITIES IN P-TYPE SILICON. P.A.Lee.
Semiconductors and phosphors. See Abstr. 9597. pp. 380-5.

The Hall coefficient and the conductivity for p-type Si specimens of various resistivities were measured at temperatures from 90° to 330° K. The values of the temperature dependences of the Hall mobility μ_H and the conductivity mobility μ were derived. In general μ_H and μ show different temperature dependence, and $\mu_H/\mu = 1.7\ T^{-0.2}$. J.B.Birks

537.311.33 : 539.232

11021. ANODIC OXIDE FORMATION ON SILICON. P.F.Schmidt.
Semiconductors and phosphors. See Abstr. 9597. pp. 570-5.

Studies of anodic oxide films on silicon, relevant to surface barrier transistors, are reported. Measurements include thickness-voltage curves, infrared absorption, time of formation at different current densities, current-voltage characteristics, rectification and photosensitivity of anodic current. J.B.Birks

537.311.33

11022. TRANSPORT PROPERTIES IN SILICON AND GALLIUM ARSENIDE. R.K.Willardson.
J. appl. Phys., Vol. 30, No. 8, 1158-65 (Aug., 1959).

High-purity n- and p-type silicon has been irradiated lightly with Co^{60} γ-rays. Analysis of the Hall mobility and magnetoresistance data indicate the introduction of levels near the conduction and valence bands. The analysis suggests the presence of triply ionized acceptors and singly ionized donors. The third ionization state of the acceptor apparently produces a level above the centre of the band gap. Under more extensive radiation a double ionization of the donors can account for the observed high resistivity. An initial increase in the magnetic field dependence of the Hall coefficient in both n- and p-type silicon may be related to the multiple ionization or to radiation annealing. The Hall mobility and transverse magneto-resistance in n-type gallium arsenide have been studied as a function of impurity concentration and density of defects introduced by fast-neutron irradiation. The change in the mobility and magnetoresistance with fast-neutron bombardment suggests the introduction of levels near the band edges and of multiply ionized levels similar to those in silicon.

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537.311.33

11023. ON THE INFLUENCE OF ANNEALING ON THE CARRIER LIFETIME OF SILICON. G.Ziegler and M.Zerbst.
Z. Naturforsch., Vol. 14a, No. 1, 93-4 (Jan., 1959). In German.

The lifetime of chemically polished samples was drastically reduced by quenching from 450°C but could be partially restored by annealing. Both quenching and annealing had no effect on sand blasted samples. Explanations are offered. R.Stratton

537.311.33 : 538.2

11024. MAGNETIC AND ELECTRICAL PROPERTIES OF REACTOR-IRRADIATED SILICON. E.Sonder.
J. appl. Phys., Vol. 30, No. 8, 1186-94 (Aug., 1959).

Magnetic susceptibility measurements above 3°K and Hall effect and resistivity determinations between 50° and 300°K are reported for n-type silicon samples irradiated with increasingly higher doses of fission neutrons. The paramagnetism due to electronic states in the forbidden gap shows an initial decrease after short irradiation but a reversal, increase, and final saturation at a value less than that originally contributed to the paramagnetism by the filled donors after longer irradiation. The Hall coefficient shows evidence of a distribution of irradiation-produced energy levels in the neighbourhood of 0.3 eV below the conduction band. The mobility goes through an initial sharp decrease with irradiation but recovers partially after longer irradiations. The results are discussed in terms of several models of radiation damage. It is concluded that a simple model based on uniformly dispersed interstitials and vacancies is not adequate to explain the results and that interactions between centres, and nonuniform distribution of damage will probably have to be taken into consideration.

537.311.33 : 539.21

RADIATION-INDUCED ENERGY LEVELS IN SILICON.
See Abstr. 10279

537.311.33

11025. ELECTRICAL PROPERTIES OF HEXAGONAL SiC DOPED WITH N, B OR Al. J.A.Lely and F.A.Kröger.
Semiconductors and phosphors. See Abstr. 9597. pp. 525-33.

Hall effect and conductivity measurements were made on p-type and n-type specimens of SiC, doped with N, B or Al, as a function of temperature. Analysis of the data leads to the following conclusions. The depth of N donor levels below the conduction band is 0.06-0.085 eV. The height of Al and B acceptor levels above the valence band is 0.275 eV. Lattice scattering causes the mobility to decrease with temperature T according to $\mu_H = a\ T^{-b}$, with b = 1.5-1.8 for electrons, and b = 2.2-3.0 for holes. The effective mass ratio for electrons in the conduction band is approximately 0.6, and for holes in the valence band is about 1.2. J.B.Birks

537.311.33 : 535.39

11026. OPTICAL AND ELECTRICAL PROPERTIES OF TIN OXIDE FILMS. K.Ishiguro, T.Sasaki, T.Arai and I.Imai.
J. Phys. Soc. Japan, Vol. 13, No. 3, 296-304 (March, 1958).

The observed Hall effect and Seebeck effect show that the specimens used are n-type conductors whose carrier density is 10^{19} to 10^{20} cm^{-3}. The optical measurements made it clear that the fundamental energy gap was about 4 eV and the plasma frequency of the conducting carriers lie in the near infrared region. By comparing the observed optical transmission and reflection with the theoretical values, which can be calculated from the electrically measured constants, the effective mass of the carriers was determined to be about 1/5 of the free electron mass. To satisfy the thermoelectric power relation with this small effective mass, it must be assumed that the Coulomb scattering of impurity ions is the predominant scattering mechanism in transparent conducting tin oxide films.

537.311.33

11027. ACTIVATION ENERGIES OF SEMICONDUCTORS WITH THE ZINC BLENDE STRUCTURE. W.B.Pearson.
Canad. J. Chem., Vol. 37, No. 7, 1191-6 (July, 1959).

Difficulties of determining the binding energies and effective charges on the atoms are the main reason why no systematic explanation of the variation of the size of the energy gap among members of the simplest family of semiconductors — those with the zinc blende structure — has ever been given. It is shown that by the choice of suitable atomic parameters for discussing the activation energies of these compounds these difficulties may be avoided, and the variation of the size of the energy gap between one compound and another can be systematically accounted for. In the treatment which develops no particular distinction need be made between the III-V, II-VI, and I-VII compounds, and it is concluded that the anomalous high or low activation energies, which certain compounds appear to have, are just the result of the relative sizes of the cations and anions in influencing the polarization of the bonds.

537.311.3

11028. ELECTRICAL CONDUCTIVITY OF ZnO—SiO_2 MIXTURES. J.Dereń, J.Haber and T.Wilkowa.
Naturwissenschaften, Vol. 46, No. 10, 350-1 (1959). In German.

Reports measurements of the variation of electrical conductivity σ with temperature of non-heat-treated and heat-treated specimens. The results are discussed in relation to σ for pure ZnO and the formation of $ZnSiO_3$ during heat treatment at 1200°C. G.C.William

537.311.3

11029. MEASUREMENT OF CARBON—METAL CONTACT RESISTANCES. H.L.Foltz and M.R.Hertz.
J. Electrochem. Soc., Vol. 106, No. 1, 67-9 (Jan., 1959).

The resistance of a carbon—metal contact, and its variation with pressure, was measured, using various metals. The effect of fluorine on the resistance was also examined, in order to decide which metals are most suitable for use in fluorine cells. P.M.Davids

537.312

11030. PHOTOMAGNETOMECHANICAL FORCES ON P—N JUNCTIONS NON-UNIFORMLY ILLUMINATED. P.Gosar.
C.R. Acad. Sci. (Paris), Vol. 248, No. 5, 658-60 (Feb. 2, 1959). In French.

The effect is demonstrated using Si junctions and its possible uses in such applications as luminous intensity measurement, rela operation and so on, are discussed. C.A.Hogar

537.312

11031. THE MEASUREMENT OF THE LIFETIME OF MINORITY CARRIERS BY THE SURFACE PHOTOVOLTAIC EFFECT. P.Gosar.
C.R. Acad. Sci. (Paris), Vol. 248, No. 22, 3139-41 (June 1, 1959). In French.

It is shown that the initial rapid decline of photovoltage in Johnson's method (Abstr. 8760 of 1958) is caused by both surface recombination and a non-uniform generation of electron—hole pair the latter generation can be made uniform by using light of sufficiently long wavelength. D.J.Hunt

537.312

11032. DETERMINATION OF THE LUMINOUS CHARACTERISTI OF PHOTOCONDUCTORS. B.M.Vulkonskii.
Pribory i Tekh. Eksper., 1959, No. 2, 136-8 (March-April). In Russian.

Describes an a.c. measuring method. Results are given for 300°C black-body radiation on PbS at room, solid CO_2 and liquid-air temperatures. Range of illumination intensities was $2.5 \times 10^{-5} - 8 \times 10^{-3}$ W/cm². The accuracy was 5-10%. R.Berm

537.312

11033. NEGATIVE PHOTOELECTRIC EFFECTS IN INORGANIC AND ORGANIC COMPOUNDS. H.Meier.
Z. wiss. Photogr., Vol. 53, No. 7-9, 117-40 (1959). In German.

A review of the quenching effect of light on electrical conductivity in various materials is followed by data on the effect in different dyes and then on silver halide. Energy band models are proposed. In the silver halides, the effect is associated with photochemical processes and the latent image formation. G.F.J.Garli

537.312

11034. THE EFFECT OF PHOTOCONDUCTIVITY OF THE BARRIER LAYER ON THE SPECTRAL DISTRIBUTION OF THE PHOTOVOLTAIC EFFECT. A.L.Rvachev and A.I.Andrievskii.
Zh. tekh. Fiz., Vol. 28, No. 9, 1939-44 (1958). In Russian.

In an earlier work (Andrievsky, Bilyi and Rvachev, Doklady Politekhnichestogo Instituta, L'vov, 1, 5, 1955), it was shown that under certain conditions the spectral response curves of some Cu_2O photoelements are characterised by three maxima, instead of two observed usually at 630 and 800 mμ. In order to explain the nature of this third maximum which occurs at 655 mμ, the effect of Cd, Mg, Bi, Ag, Al, Mn, Ni, and Sn additions (introduced before the oxidizing treatment), and of the oxidation temperature on the spect distribution of the photovoltaic effect was investigated. While the

ormal character of the spectral response curve was not affected y the presence of impurities, the third maximum on this curve as observed in the case of those specimens only, that had been xidized at temperatures higher than 1025°C. Since at these emperatures, not only does the outward diffusion of copper play the redominant part in the oxidation process but also intensive de-omposition of Cu_2O takes place, it is postulated that the investigated ffect is associated with the presence of the donor Cu atoms in the u_2O layer. M.H.Sloboda

537.312.5

1035. ELECTRONIC CONDUCTION IN AgBr CRYSTALS. .Jeltsch.
. Phys., Vol. 154, No. 5, 613-17 (1959). In German.

Measurements were made of photoconductivity rise and decay mes and the conductivity glow curves of pure AgBr, and AgBr doped ith Ag_2S and Ag_2Se. The results indicate the existence of shallow lectron traps and activation energy for electron–hole recombination. J.Franks

537.312.5

1036. LIFETIME MEASUREMENTS ON PHOTO-ELECTRONS IN dS CRYSTALS WITH A KERR CELL APPARATUS. R.Caspary.
nn. Phys. (Leipzig), Folge 7, Vol. 2, No. 3-4, 182-90 (1958).
n German.

An apparatus is described which allows light, whose frequency ay be varied from 50 to 2×10^5 c/s to be switched on and off with time constant of 0.4 μsec. Measurements on CdS indicate that e rise and decay of photo-conductivity are determined by the super-osition of a fast (several μsec) and a slow (several msec) process. ubsidiary measurements on a PbS layer gave a lifetime of 3 μsec. R.Stratton

537.312.5

1037. INVESTIGATION OF THE CHARGE-CARRIER DIFFUSION ND OF OTHER FORMS OF ENERGY TRANSPORT IN CdS. .Auth and R.Ridder.
nn. Phys. (Leipzig), Folge 7, Vol. 2, No. 7-8, 351-64 (1959).
n German.

The charge carrier concentration in the dark portion of a artially illuminated n-type crystal was experimentally determined s a function of the distance from the boundary between light and ark. Two exponential decays of the concentration with distance llow one another outwards from the boundary. The first corres-nds to a diffusion length of 3 to 15 μ for not intentionally activated rystals, 3 μ for Mn activated crystals and 27 μ for Ag activated rystals; it is associated with ambipolar diffusion which requires a fetime for holes of 10^{-9} to 10^{-7} sec. The second corresponds to a diffusion length" of 0.2 to 1.25 mm for not intentionally activated rystals and 0.15 to 0.3 mm for Ag activated crystals; it is asso-iated with the reabsorption of luminescent light. R.Stratton

537.312.5

1038. NON-STATIONARY PROCESSES IN PHOTOCONDUCTORS. . SLOW RISE OF PHOTOCURRENT IN SINGLE CRYSTALS OF dS FOR WEAK EXCITATION INTENSITIES.
.W.Böer and H.Wantosch.
nn. Phys. (Leipzig), Folge 7, Vol. 2, No. 7-8, 406-12 (1959).
n German.

For Pt I, see Abstr. 1245 (1956). The slow rise of photocurrent ith time is shown to depend on the trapping state distribution. The ffect of more than one trap depth is investigated and the rise curve nalysed for one specimen to give trap concentrations and carrier scape probabilities. G.F.J.Garlick

537.312.5

1039. THE QUANTUM YIELD OF THE INTERNAL PHOTO-FFECT IN GERMANIUM. V.S.Vavilov and K.I.Britsyn.
h. eksper. teor. Fiz., Vol. 34, No. 2, 521-3 (1958). In Russian.
nglish summary: PB 141052T-1, obtainable from Office of echnical Services, U.S. Dept. of Commerce, Washington, D.C., .S.A.

The quantum yield Q of photoconductivity in single crystals of -type Ge (specific resistance 10-20 ohm cm) has been determined ver the range of photon energies 0.8-4.9 eV. From 0.8 eV to .0 eV, Q is unity, within experimental error, but increases rapidly 3.0 eV to about 1.8 at 4.9 eV, the rate of increase becoming less higher photon energies: it is deduced that the mean energy equired for the production of an electron–hole pair must increase. he reflectivity of the specimens over the same range shows a peak about 2.0 eV, a minimum at about 3.0 eV and a general increase wards higher photon energies. C.H.B.Mee

537.312.5

11040. DETERMINATION OF THE SIGN OF THE PHOTOCURRENT CARRIERS IN ZnS-BASED PHOSPHORS. E.E.Bukke.
Optika i Spektrosk., Vol. 3, No. 4, 334-7 (Oct., 1957). In Russian.

A thin layer of a ZnS-based phosphor was placed between two electrodes. The direction of current flow on illumination gave the sign of the charge carriers. This sign was found to depend strongly on the activator used, e.g. hole conductivity was obtained with one rare-earth activator. The charge-carrier sign depended also on the method of preparation and occasionally also on the exciting light wavelength. A.Tybulewicz

537.312.5 : 535.37

THEORY OF DYNAMIC QUENCHING OF PHOTOCONDUCTIVITY AND LUMINESCENCE. See Abstr. 10803

537.312.5 : 535.343

PHOTOCONDUCTIVITY IN IRRADIATED SILICON. See Abstr. 10783

537.312.62

11041. VARIATION OF THE TRANSITION TEMPERATURE OF SUPERCONDUCTING ALLOYS OF LANTHANUM AND OTHER RARE EARTHS WITH THE SPIN OF THE SOLUTE.
A.Maradudin and J.Peretti.
C.R. Acad. Sci. (Paris), Vol. 248, No. 20, 2856-8 (May 20, 1959).
In French.

The effect of exchange interaction between the conduction electrons and the 4f electrons is calculated, using the B.C.S. model, and the variation of transition temperature is found to agree moderately well with experiment. R.G.Chambers

537.312.62

11042. THE SUPERCONDUCTING TRANSITION IN POLYCRYSTALLINE TIN. R.A.Aziz and D.C.Baird.
Canad. J. Phys., Vol. 37, No. 8, 937-43 (Aug., 1959).

The influence of grain size on the breadth of the superconducting transition in polycrystalline tin was studied. The transition was detected using an a.c. induction method. A range of grain sizes from 0.2 to 10 mm was used and the corresponding range in transition breadth is from 75 to 18 millidegrees. The influence of the grain boundaries is to broaden all the transition curves towards higher temperatures from a well-defined end point which is common to all the curves.

537.312.62

11043. PARAMAGNETIC EFFECT IN SUPERCONDUCTORS. I. QUASI-PARAMAGNETISM AND RESISTANCE OF INDIUM AT THE SUPERCONDUCTING TRANSITION. Y.Shibuya.
J. Phys. Soc. Japan, Vol. 13, No. 7, 684-94 (July, 1958).

For previous work see Abstr. 5739-40 (1959). The paramagnetic effect in indium was investigated. The minimum current I_0 necessary for the occurrence of the paramagnetic effect is represented by the same functions of the temperature T and the maximum of external magnetic field H_0, beyond which the quasi-paramagnetism at that temperature cannot be observed, as in the case of tin, i.e. $I_0 = \xi\gamma d(T_C - T)$ and $H_0 = \xi(T_C - T) - I_g/\gamma d$. Here I_g, ξ and T_C are characteristic constants of the superconductor and have values 0.6 A, 94.4 Oe/deg. and 3.422°K respectively for the case of indium, γ is 0.27 A/mm Oe. The maximum of external magnetic field H_0 and the specimen diameter d are measured in Oe and in mm, respectively. These formulae are understood in a good approximation as those for the intersection of the plane $I = I_g + \gamma dH$ with the transition surface in the (I – H – T) space. In parallel with the measurement of the magnetic flux, plotted as a function of the current at constant temperature and external magnetic field, a measurement of the resistance of the same specimen has been performed. The results obtained are in good accordance with an expression derived in a modified form from the theory proposed by Meissner.

537.312.62

11044. PARAMAGNETIC EFFECT IN SUPERCONDUCTORS. II. QUASI-PARAMAGNETISM IN NON-CIRCULAR CYLINDRICAL TIN SPECIMENS. Y.Shibuya.
J. Phys. Soc. Japan, Vol. 13, No. 7, 695-703 (July, 1958).

For Pt I see preceding abstract. Using circular cylindrical samples the author has previously shown that the minimum of current I_0 required for the appearance of the paramagnetic effect is composed of two terms, I_g and γdH_0, and that I_g is independent of the sample size. In this paper, the same effects are studied using several kinds of non-circular cylindrical samples (rectangular,

semi-circular, triangular, hollow circular, and three other forms which may show no paramagnetic effect). In the former four samples, the value of l_g has proved to be the same as in the case of circular cylinders. In the latter three samples (sandwich-type, cylinder and hollow cylinder with a longitudinal wedge-shaped slot) no paramagnetic effect was found.

537.312.62

11045. SUPERCONDUCTIVITY OF RHENIUM NITRIDE.
B.T.Matthias and W.H.Zachariasen.
J. Phys. Chem. Solids, Vol. 7, No. 1, 98 (Oct., 1958).

Rhenium nitride ($ReN_{0.34}$) powder specimens, of approximately 20-26 A crystallite size, have been found to become superconducting between 4° and 5°K. It is suggested that the particles are in effective electrical contact to make this possible; Meissner effect observations, however, put an upper limit of 2-300 A on the "effective" size of the aggregates of crystallites, the behaviour not being that of a bulk superconductor. L.Mackinnon

537.312.62

11046. SUPERCONDUCTIVITY OF Nb_3Al. E.Corenzwit.
J. Phys. Chem. Solids, Vol. 9, No. 1, 93 (Jan., 1959).

Four samples of Nb_3Al, having a β-wolfram structure and with atomic percentages of Al between 22 and 26, have been found to be superconducting with transition temperatures from 16.8° to 18°K. Specimens of another Nb–Al compound, of probably higher Al percentage and believed to be a sigma phase, have also been found to be superconducting with transition temperatures from 7° to 12°K. L.Mackinnon

537.312.62

11047. EFFECTS OF DISSOLVED GAS ON THE SUPERCONDUCTING CHARACTERISTICS OF TANTALUM.
W.B.Ittner, III and J.F.Marchand.
Phys. Rev., Vol. 114, No. 5, 1268-9 (June 1, 1959).

The addition of a metallic impurity to a monatomic superconductor is a standard technique employed in experiments where it is desirable to vary systematically some of the material properties of the specimen, e.g. the mean free path or the penetration depth. While it has long been surmized that the addition of a gaseous impurity would produce comparable effects, there appears to have been no systematic work carried out to verify this assumption or to measure the magnitude of the effects produced. In the present work the concentration of a nitrogen contaminant in tantalum was varied systematically. One effect of the nitrogen contaminant is striking: very small amounts of gas allow, by a mechanism as yet unknown, for the formation of a "substructure" which permits superconducting inclusions to exist at fields considerably higher than the so-called critical field associated with flux exclusion in the bulk of the specimen. The general behaviour of the contaminated specimens is basically the same as that observed in inhomogeneous alloys containing relatively large metallic impurity concentrations.

537.312.62

11048. ON THE FORMATION OF HYSTERESIS LOOPS OF THE RESISTANCE CURVES IN THE TRANSITION REGION TO SUPERCONDUCTIVITY. W.Meissner and R.Doll.
Z. Phys., Vol. 154, No. 5, 524-33 (1959). In German.

Measurements were carried out on a tin wire, which was thick compared with the penetration depth of the current. Disturbing temperature rises and instabilities were avoided by special devices. It was found that stable hysteresis loops occurred, both when the current was altered at constant temperature and when the temperature was altered at constant current. The reason why Buckel and Hilsch (Abstr. 9702 of 1957) did not obtain these loops may be as follows. The thickness of the thin films used by these authors is of the order of the penetration depth and therefore even in the superconductive state the current is nearly evenly distributed as in the normal state. H.London

537.312.62 : 534.221

CHANGE IN VELOCITY OF SOUND BETWEEN NORMAL AND SUPERCONDUCTING STATES IN TIN. See Abstr. 10709

537.312.8

11049. HALL EFFECT MEASUREMENT ON MAGNETITE AND A NICKEL FERRITE WITH EXCESS IRON. W.Mann.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 3-4, 122-4 (1959).
In German.

The Hall constant at room temperature was measured for a polycrystalline ferrite as a function of magnetizing field and of current flowing through the specimen. From the measured value and the value of magnetic induction, the carrier mobility was estimated as 0.44cm^2 sec^{-1}, in fair agreement with the value of 0.5 due to Lavine (1956). Experimental data are presented for the Hall constant of a nickel ferrite as a function of magnetic induction. C.A.Hogart

537.312.8 : 621.38

11050. HALL EFFECT DEVICES. W.J.Grubbs.
Bell Syst. tech. J., Vol. 38, No. 3, 853-76 (May, 1959).

A survey of these devices is given. Original work in this field is included in those sections which describe the circulator, one-piece gyrator, switch, frequency spectrum analyser, phase discriminator and digital-to-analogue encoder. Semiconductor materials are discussed in terms of what type of material is most desirable and how currently available materials limit the usefulness of Hall effect devices.

537.312.

11051. ON THE DEPENDENCE OF TRANSFER PHENOMENA IN SEMI-CONDUCTORS UPON MAGNETOCONCENTRATIONAL EFFECTS. Z.Kopeć.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 7, No. 2, 99-105 (1959).

The effect of a magnetic field on the carrier concentrations in a semiconductor are considered. Special attention is paid to the Hall effect in InSb. P.T.Landsber

537.312.

11052. NEGATIVE AND OSCILLATORY LONGITUDINAL MAGNETORESISTANCE. R.Barrie.
Canad. J. Phys., Vol. 37, No. 7, 893-6 (July, 1959).

Reports the results of numerical calculations of the longitudinal magnetoresistance of semiconductors and semi-metals for the case in which electron scattering is due to the acoustic modes of the lattice vibrations and the magnetic field is so large that quantization of electron orbits is important. The novel result is the appearance of a negative magnetoresistance $\Delta\rho/\rho_0$, and this explains partially the results of Sladek (1958) on InAs, where an oscillatory magnetoresistance was observed. C.A.Hogart

537.312.

11053. GALVANOMAGNETIC PHENOMENA IN Pt AT LOW TEMPERATURES. E.S.Borovik and V.G.Volotskaya.
Fiz. Metallov i Metallovedenie, Vol. 6, No. 1, 60-6 (1958).
In Russian.

The electrical resistivity, Hall coefficient and magnetoresistance of Pt were measured at temperatures of 4.2°-20°K and in magnetic fields of 0-27 000 Oe. To explain the results it is necessary to postulate four groups of current carriers, two n-type (n_1, and two p-type (n_2, n_4). The numbers of these per atom n_i/n_a and their mobilities τ_i/m_i^* (mean time of flight/effective mass) are:

Group	1	2	3	4
n_i/n_a	0.10	0.18	0.55	0.47
$\tau_i/m_i^* \times 10^{-15}$	19	20	1.3	4.1

where of course, $n_1 + n_3 = n_2 + n_4$. The ratio of the mean effective mass to the mass of the free electron ($\bar{m}^*/m_e$) = 8, as compared with $\bar{m}^*/m_e$ = 22 as given in Seitz: "Modern Theory of Solids", p. 159, McGraw Hill (1940). Mobilities are an order of magnitude less than in non-transition metals. 13 references. A.F.Brov

537.312.

11054. RELATIONS BETWEEN THE COEFFICIENTS OF THE GALVANOMAGNETIC AND THERMOMAGNETIC TRANSVERSE EFFECTS IN FERROMAGNETICS. G.Busch, F.Hulliger and R.Jagg
Helv. phys. Acta, Vol. 31, No. 1, 3-16 (1958). In German.

The relations, analogous to that for the Hall effect, are established for the other transverse effects, and the values of the field parameters α compared for Ni. Other parameters are also compa using formal relations due to Bridgman. E.P.Wohlfar

537.312

11055. MAGNETORESISTANCE AND SIZE EFFECTS IN INDIUM AT LOW TEMPERATURES. J.L.Olsen.
Helv. phys. Acta, Vol. 31, No. 7, 713-26 (1958).

Resistance measurements were made at liquid helium temperature on pure indium wires ranging in thickness from 0.06 to 2.5 m

The dependence on size was used to determine the bulk mean free path of the electrons. A deviation from Matthiessen's rule was observed. Magnetoresistance changes were measured in longitudinal fields up to 12 000 Oe, and in transverse fields up to 8000 Oe. Size effects were observed here too. It is shown that the present theory can explain the low-field results, but is less reliable at high fields. C.Hilsum

537.312.8

1056. HALL EFFECT IN OXIDE CATHODES. T.Yabumoto.
J. Phys. Soc. Japan, Vol. 14, No. 2, 134-9 (Feb., 1959).

The measurement of Hall effect in oxide cathodes was carried out on samples prepared by various methods. The apparent electron mobility in a temperature range 700°-1200°K was about 10^3 to 10^4 $cm^2/V.sec$. These values are very high as compared with that for a single crystal. The effect of porosity upon the mobility seems to exist to some extent, the porosity being changed by means of the different preparations and treatments of the cathodes. From the viewpoint of pore conduction the mean free path of an electron is about 10^{-5}-10^{-3} cm which seems to be of the same order as the size of pores existing in the actual oxide cathodes.

537.312.8

1057. VARIATION OF HALL COEFFICIENT OF SOME NON-FERROMAGNETIC SUPERLATTICE ALLOYS.
K.Yonemitsu and T.Sato.
J. Phys. Soc. Japan, Vol. 13, No. 9, 998-1004 (Sept., 1958).

The temperature dependence of the Hall coefficient of five superlattice alloys (Cu_3Pd, CuZn, Ni_3Cr, Au_3Cu and Ag_3Mg) was measured to find the effect of order–disorder transformation upon it. At the transition temperature, the coefficient of Cu_3Pd and Ag_3Mg showed a discontinuous change, while the change of the coefficient of the other three alloys is very small. Applying Muto's theory, a qualitative analysis was made, and it was found that the general features of the temperature dependence of CuZn and Ni_3Cr are well represented by the theory. For Au_3Cu, the result of the experiment is explained by adopting the assumption of Schubert that each Au atom contributes more than one electron to the conduction band. This assumption also explains why the temperature dependence of Hall coefficient of Au_3Cu differs from that of Cu_3Au. It remains unknown why the coefficient of Cu_3Pd has a strong minimum at the transition temperature, while the abrupt increase of the coefficient with decreasing temperature below T_c can be explained by the existence of a superzone in the ordered state. In addition, the result for Ag_3Mg is contrary to that which Nicholas's theory suggests.

537.312.8

11058. HALL COEFFICIENT OF MOLYBDENUM DISILICIDE.
M.J.Arvin and R.F.Tipsord.
J. Phys. Chem. Solids, Vol. 9, No. 3-4, 336-7 (March, 1959).

The Hall coefficient was $10.4 \pm 0.2 \times 10^{-12}$ (V cm)/AG and was independent of temperature between 25° and 445°C. The resistivity was 26.4×10^{-6} ohm cm, but the temperature coefficient of resistivity depended on the history of the sample. D.J.Oliver

537.312.8

11059. INFLUENCE OF A HIGH-FREQUENCY MAGNETIC FIELD ON THE HALL EFFECT IN SEMICONDUCTORS OF HIGH CONDUCTIVITY. F.Kuhrt, H.J.Lippmann and K.Wiehl.
Naturwissenschaften, Vol. 46, No. 10, 351-2 (1959). In German.

The alternating Hall voltage due to an alternating magnetic field and steady specimen current is enhanced by eddy currents set up in the specimen. The results of a theoretical calculation of this effect are given and are shown to be in reasonable agreement with experiments on InAs. The Hall voltage, in this case, is increased by 35% at a frequency of 1.5 Mc/s. K.W.Plessner

537.312.8

11060. ANOMALOUS BEHAVIOUR IN THE HALL COEFFICIENTS OF THE SEMICONDUCTING COMPOUNDS SnSe AND GeSe.
S.Asanabe and A.Okazaki.
Proc. Phys. Soc., Vol. 73, Pt 5, 824-7 (May, 1959).

Describes anomalous variations of resistivity and Hall coefficient with temperature for quenched and annealed specimens of p-type single crystals of SnSe and p-type polycrystals of GeSe. Presence of electron trap level in the forbidden energy band or diffusion at high temperatures of impurity atoms, which are trapped in vacancies and form new acceptors in the crystal, are assumed in the interpretation of the results. G.C.Williams

537.312.8

11061. LONGITUDINAL MAGNETORESISTANCE OF METALS IN HIGH FIELDS. B.Lüthi.
Phys. Rev. Letters, Vol. 2, No. 12, 503-4 (June 15, 1959).

A saturation in the longitudinal magnetoresistance v. field curves for polycrystalline Cu was reported previously. The transverse magnetoresistance increases linearly without limit. Similar results are reported for polycrystalline Zn, Pt, Ag, Sn, Au, Ni, but no saturation effects are found for Li and Pb. C.A.Hogarth

537.32

11062. ON THE THEORY OF THE THERMOELECTRICITY IN TWO-BAND SEMICONDUCTORS. E.Haga.
J. Phys. Soc. Japan, Vol. 14, No. 1, 35-8 (Jan., 1959).

The thermoelectromotive forces of a circuit composed of two different conductors is often expressed by an integral of the field $\oint \vec{E} \cdot d\vec{l}$ along the circuit, with two junctions at different temperatures. This definition is not free from ambiguity when one deals with two-band semiconductors. In the present paper, a theory of the thermoelectricity of two-band semiconductors is developed, taking into consideration the temperature dependence of the gap energy. The Thomson relations are proved to be satisfied.

537.323

11063. THERMOELECTRIC POWER OF LiF BETWEEN 365 AND 605° C. H.Curien and Z.Mihailovic.
C.R. Acad. Sci. (Paris), Vol. 248, No. 21, 2982-3 (May 25, 1959).
In French.

537.323

11064. THERMOELECTRIC POWER AND MEAN FREE PATH IN THIN SLICES OF COBALT. F.Savornin.
C.R. Acad. Sci. (Paris), Vol. 248, No. 22, 3133-5 (June 1, 1959).
In French.

The thermoelectric power of cobalt was measured as a function of specimen thickness at 423° K with respect to silver. The results were in agreement with theory and for the bulk material a value of $\phi_{Co} - \phi_{Ag} = -30.5 \pm 0.5$ μV/deg K was obtained. Assuming Bloch's relation between mean free path l and energy E, $l \propto E^n$, a value of $n = 2.3 \pm 0.5$ is deduced. D.J.Huntley

537.323

11065. THE THERMOELECTRIC PROPERTIES OF SOME METAL-LIKE COMPOUNDS.
N.V.Kolomoets, V.S.Neshpor, G.V.Samsonov and S.A.Semenkovich.
Zh. tekh. Fiz., Vol. 28, No. 11, 2382-9 (1958). In Russian.

The study was presumably made in the hope of finding an efficient substance for the thermal generation of electricity. The compounds studied were TiC, ZrC, NbC, TaC, WC, TiN, TaN, TiB_2, ZrB_2, VB_2, NbB_2, TaB_2, Mo_2B_5, W_2B_5, $NiSi_2$ and $FeSi_2$. The methods of synthesis of the sintered and annealed specimens are given, together with their specific weights, chemical compositions and porosities. The electrical resistivities, ρ, and thermoelectric powers, α, were measured (300°-1400°K) in an apparatus described in detail. The borides and carbides had metallic properties ($\rho \sim 40$-400 μΩ/cm, $\alpha \sim \pm 3 \times 10^{-9*}$ V/°K). The silicides and nitrides were less clearly metal-like; $FeSi_2$, for example, had a larger ρ (which decreased with temperature above 900°K) and large α ($\sim 6 \times 10^{-9*}$ V/°K at 1300°K). [* A misprint in the original paper is suspected here; it is thought that these values of α should be $\times 10^{-6}$, not $\times 10^{-9}$]. K.F.Hulme

537.324

11066. THERMOCOUPLES WITH CURVED CHARACTERISTICS COMPOSED OF Fe–Al–Cr AND Cu–Ni ALLOYS.
Y.Shirakawa, T.Ôhara and D.Amemiya.
Sci. Rep. Res. Insts Tohoku Univ. A, Vol. 11, No. 3, 190-200 (June, 1959).

The thermo e.m.f. of Fe–Al (~8.2% Al), Fe–Cr (~14.8% Cr), Fe–Al–Cr (~ 6.2% Al, ~ 11.4% Cr) and Cu–Ni (~ 4.9% Ni) alloys was measured in the range from 100° to 800° C. The thermocouple composed of a pair of Cu–1.9% Ni and Fe–6.2% Al–0.94% Cr alloys had an e.m.f. that was almost zero from room temperature to 400° C and then increased with temperature to 5.4 mV at 800° C.

537.36

11067. THEORY OF ELECTRODIFFUSION.
T.A.Bak and W.G.Kauman.
Trans Faraday Soc., Vol. 55, Pt 7, 1109-21 (July, 1959).

A theory based on macroscopic transport equations, rather than

on stochastic arguments, is proposed. For a constant applied field the present theory confirms results previously obtained by Mysels (1956); with an alternating field it gives different results. The diffusion equations which arise are Fourier-transformed to give equations of the Hill-type or are solved by time-dependent perturbation techniques leading to essentially the same equations. The possible use of this effect as a method of determining rate constants is discussed. The theory also shows that measurements of the diffusion constant may possibly be replaced by electrical measurements.

537.36

11068. ELECTROKINETIC STREAMING, VISCOUS FLOW AND ELECTRICAL CONDUCTION IN INTER-FIBRE NETWORKS. THE PORE ORIENTATION FACTOR. G.J.Biefer and S.G.Mason.
Trans Faraday Soc., Vol. 55, Pt 7, 1239-45 (July, 1959).

In treating viscous flow, electrokinetic phenomena and electrical conductivity of liquids contained in porous materials, the pore system is often represented by an equivalent capillary network in which the pore-orientation (or tortuosity) factor is considered to be identical for the three. Measurements over a wide range of void fractions ϵ on pads of both non-swelling and swelling fibres have shown instead that the pore-orientation factor is proportional to $\epsilon^{3/2}$ for electrokinetic movement and to ϵ for ionic conduction, but is constant for permeation. These differences account for discrepancies previously observed between the swollen specific volume determined by permeability and stream current measurement. They also serve to demonstrate that the conventionally-used Briggs method of evaluating the ζ-potential is invalid, and that the absolute values of all ζ-potential measurements based on streaming and electro-osmotic measurements reported in the literature, except those for single circular capillaries, are probably in error.

ELECTRIC DISCHARGES

537.523

11069. THE ELECTRON TEMPERATURE AND ELECTRON STREAM IN THE HIGH FREQUENCY TORCH DISCHARGE. L.Mollwo.
Ann. Phys. (Leipzig), Folge 7, Vol. 2, No. 3-4, 97-129 (1958). In German.

A very detailed theoretical and experimental study of the u.h.f. torch discharge, previously described also by Mumford, Cobine and others. Electron temperatures (data are given for air and nitrogen discharges) of about 13 500° K were obtained, with gas temperatures much lower than this figure. A wavelength of 20 cm was used. Experimental arrangements and results are given, with a full discussion of the discharge mechanism, etc. J.D.Craggs

537.523.3 : 537.525.3

11070. INFLUENCE OF EXTERNAL ATMOSPHERE ON A.C. SILENT DISCHARGES. P.S.V. Setty.
Curr. Sci., Vol. 28, No. 5, 195 (May, 1959).

A brief note describing experiments on the stability and reproducibility of ozonizer high-voltage a.c. corona discharges in iodine vapour. J.D.Craggs

537.523.74

11071. ON THE THEORY OF THE HIGH-FREQUENCY "FLAME" DISCHARGE. R.Grigorovich and Dzh.Kristesku.
Optika i Spektrosk., Vol. 6, No. 2, 129-36 (Feb., 1959). In Russian.

A quantitative theory is given of the mechanism of a high-frequency discharge from a single sharp electrode (known as a "flame" discharge). The energy balance in the discharge is taken as the basis of the calculations. If luminescence is neglected, the discharge may be considered as a cylindrical region of very hot gas, ionized and heated due to periodic motions of charge carriers. The authors show that the only important mechanism of energy loss is that due to radial thermal conductivity. The Elenbaas–Heller differential equation is used to develop a theory of the "flame" discharge. This theory is compared with experiment for 12.4 to 100 Mc/s 20-200 W discharges in air between a sharp-pointed electrode and a plane 5 cm away. Fairly satisfactory agreement was obtained between the theoretical and experimental values of the gas temperature at the discharge axis, the discharge current and the electron temperature. The authors conclude that: (a) above 70 Mc/s the plasma of discharges in air at atmospheric pressure is isothermal, i.e., the electron and gas temperatures are similar; (b) below 30 Mc/s thermal ionization of air is insufficient to explain the value of the electrical conductivity of the discharge plasma. In molecular gases with low thermal conductivity, such as N_2, O_2, CO_2, the "flame" discharges are similar to those which take place in air: the plasma is hot and in an almost isothermal condition. In molecular gases with high thermal conductivity, such as hydrogen and town (coal) gas, it is difficult to reach high temperatures and consequentl the "flame" discharges are produced with difficulty in the town gas and not at all in hydrogen. Inert gases are poor heat conductors but transfer of energy between electrons and gases is difficult because of the absence of easily excited molecular vibrations. For this reason, "flame" discharges in pure inert gases (He,A) reach only comparatively low temperatures. A.Tybulewicz

537.523.74

11072. OSCILLOGRAPHIC STUDY OF R/F OSCILLATIONS IN "SILENT" ELECTRICAL DISCHARGES. P.S.Venkataswamy Setty.
Proc. Nat. Inst. Sci. India A, Vol. 24, No. 4, 235-9 (1958).

The paper furnishes oscillographic evidence of the r.f. oscillations produced at suitable exciting voltages of 50 c/s in (i) iodine vapour and (ii) hydrogen gas discharge tubes fitted with external "sleeve"-electrodes. A beat-frequency amplifier was employed in which the r.f. oscillation of a particular discrete frequency in the "silent" electrical discharge was amplified and made to "beat" with the oscillation of a suitably adjusted r.f. from an oscillator, yielding an intermediate frequency which was delineated, after amplification, on the fluorescent screen of a cathode-ray oscillograph. The above oscillographic study of the r.f. oscillations in iodine vapour and hydrogen gas under "silent" electrical discharge was made with and without light falling on the discharge tubes. The experimental results are described and discussed in the paper.

537.525 : 539.1

ION RUNAWAY IN ZETA. See Abstr. 10141

537.525.07 : 621.316.57

11073. HIGH-VOLTAGE, LOW-INDUCTANCE SWITCH FOR MEGAMPERE PULSE CURRENTS. W.R.Baker.
Rev. sci. Instrum., Vol. 30, No. 8, 700-2 (Aug., 1959).

A switch is described that will handle pulse currents of several millions of amperes and stand off d.c. supply voltages of over 30 kV. It is useful in powering fast pinch devices such as those used in thermonuclear research.

537.525.8

11074. GAS SEPARATION PROCESSES IN D.C. GLOW DISCHARGE K.H.Krysmanski.
Ann. Phys (Leipzig), Folge 7, Vol. 2, No. 5-6, 263-73 (1958). In German.

This study of the concentration distributions of the separating components after the attainment of equilibrium was made in terms of gas pressure, current strength and tube dimensions. Mixtures of the same gases, for the pressure range ~ 1 to 12 mm Hg, were studied. J.D.Craggs

537.525.8

11075. SOME RESULTS ON MOVING STRIATIONS IN NEON GLOW DISCHARGES. H.Achterberg and J.Michel.
Ann. Phys. (Leipzig), Folge 7, Vol. 2, No. 7-8, 365-79 (1959). In German.

The way in which the production and properties of self-excited moving striations depend on parameters such as discharge current, anode–cathode distance and external resistance was investigated experimentally. Striations produced artificially by sinusoidal perturbation of a plasma were then studied under conditions chosen to eliminate self-excited striations. J.Dutton

537.525.8

11076. A SIMPLIFIED THEORY OF MOVING STRIATIONS. K.Wojaczek.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 1-2, 37-47 (1959). In German.

The paper is mainly analytical and gives the detailed theory of moving striations in low-pressure glow discharges. Comparisons with experimental data are drawn for a 1 mm Hg argon discharge at 2.1 A, with an electron temperature of 14 500° K. J.D.Craggs

537.525.8

11077. MOVING STRIATIONS IN ARC DISCHARGE. H.Yoshimoto, M.Sato and Y.Nakao.
J. Phys. Soc. Japan, Vol. 13, No. 7, 734-41 (July, 1958).

In the same manner as in a glow discharge, moving striations

re observed in an arc discharge. From the patterns of light oscill-tion, a light intensity wave travelling towards the cathode is obtained. he phenomenon of the moving striations is one manifestation of the ght intensity wave which occurs due to an interaction between the llowing two waves, a space charge wave travelling towards the athode and an electron density wave. The former changes the lectron emission of the cathode, and this produces the latter. The tationary striations observed in the positive column also seem to e one aspect of the light intensity wave.

537.525.98

1078. MOVING STRIATIONS DUE TO SPACE CHARGE WAVES. .Yoshimoto, M.Sato and Y.Nakao.
. Phys. Soc. Japan, Vol. 13, No. 7, 741-8 (July, 1958).

In the positive column there exists a light intensity wave ravelling towards the cathode. This wave is assumed to be pro-ortional to the product of the electron density wave and the electric eld wave. The equation for such a light intensity wave is con-idered. All the characteristic properties of the moving striations educed from the analysis of the equation are presented here and re in accord with those of the observed moving striations. From ie phenomena of the moving striations, information on the space harge waves in plasma can be obtained.

537.525.8 : 535.332

1079. POLARIZATION OF LIGHT FROM THE CATHODE GLOW. .S.Shepherd.
roc. Phys. Soc., Vol. 73, Pt 1, 126-8 (Jan., 1959).

A full description is given of the apparatus used to investigate ie polarization of the Balmer line Hβ, which is prominent in the pectrum of the cathode glow of a discharge through hydrogen. It as estimated that a ratio of 0.05 for $(J_1 - J_2)/(J_1 + J_2)$ could be de-ected, where J_1 and J_2 are the intensities of the light with electric ector perpendicular and parallel respectively to the discharge tube xis. With cathode falls up to 1500 V, with currents of about 1 mA nd pressures of order of 0.1 mm Hg, no polarization was found. eeliger and Handt (Abstr. 1582 of 1930) obtained ratios of 0.25 for ie mercury line. The difference is not explained. H.G.Jerrard

537.525.8

1080. NOTE ON THE CATHODE GLOW. K.G.Emeleus.
roc. Phys. Soc., Vol. 73, Pt 5, 822-4 (May, 1959).

A discussion of certain observations by Shepherd (preceding ostract) where Hβ was found to be unpolarized, in apparent contra-iction to certain results of Seeliger and Handt. The present note larifies the situation, by reference to random motion and other ffects; in conclusion there is no definite inconsistency.

J.D.Craggs

537.527.5

1081. SPECTRAL RADIATION INTENSITY DISTRIBUTION AND NERGY BALANCE FOR XENON HIGH-PRESSURE LAMPS AT IGH LOADINGS. H.Grabner and H.Schlegel.
ech. wiss. Abhandl. Osram-Gesell., Vol. 7, 26-35 (1958).
n German.

Describes measurements made on various Osram lamps with filter subtraction technique. A set of five filters (bandpass type) overed the spectral range investigated. Radiation data are given n detail. J.D.Craggs

537.527.5

1082. ON THE ARC MECHANISM AT METAL CATHODES IN IGH-PRESSURE DISCHARGES. A.Bauer.
ech. wiss. Abhandl. Osram-Gesell., Vol. 7, 39-51 (1958).
n German.

Discusses briefly some current theories of cathode spot mech-nisms and stresses particularly transitions from thermal to field urrent arcs. Studies of current–voltage and current density haracteristics etc. for xenon arcs carrying up to 10 A current or pressures varying from 1 to 60 atm are discussed in detail.

J.D.Craggs

537.528

1083. SOME RULES GOVERNING THE ELECTRIC BREAKDOWN F LIQUID DIELECTRICS. I.E.Balygin.
zv. Akad Nauk SSSR, Ser. fiz., Vol. 22, No. 4, 433-8 (1958). In ussian. English summary : PB 141041T-4, obtainable from Office f Technical Services, U.S. Dept. of Commerce, Washington, D.C., .S.A.

A series of oscillographs is shown for breakdown in transformer il, vaseline (at 40° C) and other liquids. Differences of behaviour re ascribed to the physical and chemical composition of the liquids and their structures. Some liquids eject liquid from between the electrodes, probably due to a sudden deionization. The viscosity dependence of the deionization was checked with 1-6% solutions of acetyl cellulose in toluene, and the oscillographs obtained are given. R.C.Kell

537.529

11084. A STUDY OF THE DIRECTIONAL EFFECTS IN THE ELECTRICAL RUPTURE OF KCl. A.Fernández.
Rev. Mexicana Fis., Vol. 7, No. 3-4, 129-38 (1958). In Spanish.

The electric field was applied in the 110 direction and ruptures obtained in the 100 direction. (See Abstr. 5943 of 1958).

J.M.Hough

X-RAYS

537.531

11085. ABSOLUTE DOSIMETRY FOR X-RAYS OF 23 keV MEAN ENERGY. STANDARDIZATION OF FERROUS SULPHATE. M.Frilley and M.Lefort.
J. Phys. Radium, Vol. 20, No. 5, 516-18 (May, 1959). In French.

The dose rate from an X-ray beam generated by a tin anode in an X-ray tube under 100 kV was measured with an absolute ionization chamber. The yield of oxidized ferrous sulphate in aqueous sulphuric acid solutions was determined. For an effective mean energy of 23 keV, the value of 15.1 ± 0.5 ions oxidized for 100 eV was found, a figure slightly smaller than with radiocobalt γ-rays. The dependence of this yield on the energy of the electrons is discussed.

537.531 : 535.331

11086. PRECISION MEASUREMENT OF K X-RAY SPECTRUM OF Hg. O.Beckman and P.Bergvall.
Phys. Rev., Vol. 114, No. 5, 1280-1 (June 1, 1959).

The K X-ray spectrum of Hg has previously not been measured with the same accuracy as nearby elements because of the difficulty of obtaining a good anticathode. A wavelength determination of Hg $K\alpha_1$, α_2, β_1, β_3 is reported with an accuracy of less than 40 p.p.m. Using these data an earlier measurement of the weaker Hg lines (Abstr. 2353 of 1958) is recalculated to give higher accuracy.

537.531 : 535.33

11087. THE $K\alpha_3$ AND $K\beta'$ SATELLITES OF X-RAY SPECTRUM LINES. T.I.Kakuschadse.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 7-8, 352-9 (1959).
In German.

An extension of Bloch's theory of satellite lines leads to a satisfactory explanation of the origin of the $K\alpha_2$ and $K\beta'$ lines in terms of electron interaction with the thermal vibrations of the lattice. The extended theory also gives an explanation for the observed asymmetry of the $K\alpha_1$ and $K\alpha_2$ T.Mulvey

537.531 : 535.43

11088. A NEW STUDY OF THE L SPECTRUM OF GERMANIUM. A.Lucasson-Lemasson.
C.R. Acad. Sci. (Paris), Vol. 248, No. 8, 1156-8 (Feb. 23, 1959).
In French.

Describes the observation of the L_I absorption edge of germanium at 8.773 A as well as a re-determination of the L_{II} and L_{III} edges. The L_I edge was most clearly observed in a film of germanium 0.3 microns thick. Electron diffraction was used to check crystallinity. T.Mulvey

537.531 : 535.33

11089. STUDY OF THE K EMISSION BAND OF MAGNESIUM. P.Callon.
C.R. Acad. Sci. (Paris), Vol. 248, No. 13, 1985-7 (April 1, 1959).
In French.

The width of the K emission band was determined for metal and for the oxide. The results are compared with previous experimental and theoretical values. T.Mulvey

537.531 : 535.345

11090. COBALT K-ABSORPTION EDGES IN SUPPORTED COBALT-ON-ALUMINA AND COBALT-ON-SILICA CATALYSTS. R.O.Keeling,Jr.
J. chem. Phys., Vol. 31, No. 1, 279-80 (July, 1959).

The positions and shapes of the absorption edges indicate that

on Al_2O_3 the Co is present as Co_3O_4 at high concentrations, with increasing amounts of Co^{+2} at lower concentrations of Co. On SiO_2 the Co is entirely Co_3O_4. G.F.Lothian

537.531 : 535.343

11091. FINE STRUCTURES OF X-RAY K ABSORPTION SPECTRA OF NICKEL IN OXIDES OF NICKEL. K.Tsutsumi.
J. Phys. Soc. Japan, Vol. 13, No. 6, 586-90 (June, 1958).

The fine structures of X-ray K absorption spectra of nickel in metallic nickel, NiO, Ni_2O_3 and $NiO_2.nH_2O$ were photographed by a bent crystal spectrograph. The fine structures of absorption spectra of metallic nickel and NiO agree well with those published by previous authors, but those of Ni_2O_3 do not coincide with those reported by Hayasi and Cauchois. Also Cauchois' data of Ni_2O_3 do not coincide with Hayasi's data. This seems to be due to doubtful chemical structures of Ni_2O_3 and it is supposed that the three specimens used by the three authors might have different chemical structures. The first absorption maxima A are much more pronounced with increasing oxygen proportion and the general features of α, β, C and γ of the absorption spectra of oxides are similar respectively. However, the second small absorption maxima B are less pronounced with increasing oxygen proportion. These facts are expected from Coster and Kiestra's and Cauchois' considerations. It may be considered from the comparison of the present curves of absorption spectra only that nickel sesquioxide is a mixture of NiO and $NiO_2.nH_2O$.

537.531 : 535.343

11092. FINE STRUCTURES OF THE X-RAY ABSORPTION BY THE SINGLE CRYSTAL OF GERMANIUM.
K.Tsutsumi and M.Obashi.
J. Phys. Soc. Japan, Vol. 13, No. 6, 591-6 (June, 1958).

This was investigated. These crystals were used as an analysing crystal of a spectrometer, and at the same time as an absorber. The intensities of general radiation reflected from (100), (110), and (111) planes were investigated. The fine structures of intensities reflected from these planes were in agreement with those of absorption spectrum reported by Doran and Stephenson obtained by the transmission method using a single crystal as an absorber. However, they reported a weak fine structure near the absorption edge which was not observed here. The observed fine structure of the absorption can be interpreted in terms of Kronig's theory, while the absence of the fine structure near the absorption edge is due to the anomalous scattering of germanium on the one hand and to the thickness effect reported by Parratt, Hempstead and Jossem on the other.

ELECTRON EMISSION . ELECTRON BEAMS

537.533

11093. EXO-ELECTRON EMISSION FROM THIN ALUMINIUM LAYERS. V.Střelka.
Czech. J. Phys., Vol. 8, No. 3, 377-8 (1958). In German.

Exo-electron emission v. temperature curves during heating of thin aluminium layers show several peaks indicative of different metastable states for electrons. Stimulation of the exo-electron emission by light is studied with respect to spectral response, and correlation shown with the states revealed by heating.
G.F.J.Garlick

537.533

11094. ON CONNECTION BETWEEN THE WORK FUNCTION OF ELECTRONS FROM HEXABORIDES OF ALKALI-EARTH AND RARE-EARTH METALS AND THEIR ELECTRON STRUCTURE.
G.V.Samsonov and V.S.Neshpor.
Dokl. Akad. Nauk SSSR, Vol. 122, No. 6, 1021-4 (1958) In Russian.

Gives a short analysis of the theoretical and experimental results obtained by previous workers using them as a basis for the discussion on the problem. J.M.Zarzycki

537.533

11095. THE ROLE OF THE EMITTER SHAPE IN COLD EMISSION RESEARCH. R.Męclewski and L.Wojda.
Acta phys. Polon., Vol. 16, No. 1-2, 25-33 (1957).

Observations were made of the changes of electron patterns from iron and nickel points, these changes taking place under the influence of changes of temperature and voltage. It was established that the emission of electrons from weakly heated points takes place from the corners and edges of the monocrystalline point. A a result of surface migration or plastic deformation, there occurs on the corners a piling up, which causes a local increase in the electric field intensity. Therefore, distribution of the current in the electron pattern maps the shape of the surface of the monocrystal forming the end of the point. The observed effect permits one to assume that the different values for the work function obtained from the surfaces of the monocrystal by various authors result fr various degrees of rounding of the point.

537.5

11096. ON THE QUESTION OF EXO-ELECTRON EMISSION FRO SEMICONDUCTORS. R.Menold.
Naturwissenschaften, Vol. 46, No. 4, 138-9 (1959). In German.

Measurements on n-type ZnO are interpreted in terms of a model involving chemisorbed oxygen on the surface. R.Stratt

537.533 : 548

EXO-ELECTRON EMISSION DUE TO CRYSTAL CLEAVAGE.
See Abstr. 10355

537.5

11097. PICTURES OF AUTOELECTRONIC EMISSION OF CRYST OF TUNGSTEN CARBIDE AND MOLYBDENUM CARBIDE.
A.P.Komar and Yu.N.Talanin.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 580-93 (1958). In Russian. English summary: PB 141041T-5, obtainable from Offic of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

Field emission images obtained from tungsten and molybdenu tips were found to show hexagonal symmetry, although the structu of both metals is body-centred cubic. Results obtained with an improved emission microscope lead to the conclusion that the ima are due to the carbides W_2C and Mo_2C, respectively; the mono- compounds, WC and MoC, which might have been expected, were not present. V.E.Cossle

537.5

11098. SOME PROPERTIES OF POLY-ALKALI PHOTOCATHOD
A.A.Mostovskii, O.B.Vorob'eva and K.A.Maiskaya.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 561-5 (1958).
In Russian. English summary: PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washingtor D.C., U.S.A.

Further investigations on photocathodes of the type Sb-K-Na- first described by Sommer (Abstrs. 9667 of 1955; 3552 of 1959) ar reported. The variation in optical properties and spectral sensiti of the photocathodes as sodium is applied after potassium is studi After caesium treatment, thermionic emission and electrical con- ductivity measurements show that the external work function chan by 0.5 - 1.4 eV while the internal work function remains constant. This change in the potential barrier between the cathode and vacu can be obtained by oxygen activation instead of by caesium treatm but this method leads to an increase in dark current. Preliminary experiments suggest that fatigue effects are small. C.H.B.M

537.5

11099. TEMPERATURE COEFFICIENT OF THE PHOTOELECTI EFFECT OF METALS. A.Meessen.
J. Phys. Radium, Vol. 20, No. 5, 519-28 (May, 1959). In French.

The temperature coefficient of the photoelectric current is positive near the threshold, but becomes negative towards the blue and ultraviolet. This is due to a surface photoelectric effect whos work function is linearily temperature dependent (second-order effect). This assumption has already been introduced for the therm ionic emission process. Agreement between experimental and the etical curves requires however the following assumptions: (1) The work function depends also on T^2 (third-order effect). This corrob orated by the proportionality between the temperature coefficient c the work function and the thermal expansion coefficient. (2) The Fowler formula for the photoelectric current becomes inaccurate when T and x increase and has to be replaced by an other expressi containing a T^3 term.

537.5

11100. THE THEORY OF THE SECONDARY ELECTRON EMIS- SION FROM METALS. THE EXCITATION PROCESS.
H.W.Streitwolf.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 3-4, 183-96 (1959).
In German.

The excitation of the inner electrons by primary electrons of moderate energy is calculated by Dirac's perturbation method in a single electron approximation. A.H.W.Be

537.533

11101. THE THEORY OF THE SECONDARY ELECTRON EMISSION FROM METALS. THE TRANSPORT PROCESS. H.Stolz. Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 3-4, 197-210 (1959). In German.

The internal distribution function of the excited electrons is calculated using the Boltzmann transport equation. The angular distribution in energy for the external electrons can then be found. Results for a particular model are given and are in reasonable agreement with measurements. A.H.W.Beck

537.533 : 539.23

11102. INVESTIGATION OF THE STRUCTURE AND OF THE PROPERTIES OF TAPERED FILMS OF Ge, Cr AND Bi IN CONNECTION WITH THEIR SECONDARY EMISSION PROPERTIES. N.G.Nakhodkin and A.I.Novosel'skaya. Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 4, 448-53 (1958). In Russian. English summary: PB 141041T-4, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The dependence of the secondary electron emission coefficient δ on the surface film thickness (d) was investigated. δ was found to vary with increasing d up to a limiting thickness $d_{eff.}$ known as the effective depth of secondary emission. $d_{eff.}$ changed only slightly with a variation of the primary electron energy and was smaller for the metal chromium than for germanium. The effect of electron bombardment on the crystal structure of thin films of bismuth, chromium and germanium was also studied. W.G.Townsend

537.533

11103. THE DEPENDENCE OF THE COEFFICIENT OF SECONDARY EMISSION IN KCl ON THE THICKNESS OF THE LAYER. N.G.Nakhodkin and V.A.Romanovskii. Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 4, 454-5 (1958). In Russian. English summary: PB 141041T-4, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Layers of KCl on a Be base were bombarded with electrons of energy 480-6000 eV, and the secondary electron emission coefficient determined as a function of thickness of the KCl layer. The effective depth of secondary emission is found to be about 50 mμ. C.H.B.Mee

537.533

11104. SECONDARY ELECTRON EMISSION OF ANTIMONY–CAESIUM EMITTERS AT "SHOOTING THROUGH". A.I.Pyatnitskii. Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 4, 464-72 (1958). In Russian. English summary: PB 141041T-4, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Sb–Cs secondary emitters, prepared on glass film substrates, were bombarded by primary electrons of energy up to 23 kV. Curves relating the coefficient of passage of electrons through the glass to the primary electron energy are given. The variation of the secondary emission coefficient δ with primary energy V_p for various Sb and glass thicknesses is compared with δ v. V_p curves for an emitter poisoned by air. The latter show a reduction in the number of secondary electrons after the current maximum. δ is found to be dependent on the current density in the primary beam. The results are in agreement with the hypothesis that the secondary emission of such emitters is mainly determined by the nature of the excitation process. C.H.B.Mee

537.533

11105. THE SECONDARY EMISSION OF THORIUM OXIDE, ACTIVATED BY BARIUM. B.N.Popov and V.F.Koliverdov. Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 496-504 (1958). In Russian. English summary : PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The main requirements for emitters for use in magnetrons are given. These can be met by a search for new compounds and suitable treatment of existing ones. The increase in secondary emission of barium activated thorium oxide is ascribed to the oxidation of metallic barium by residual oxygen. The need for experiments in ultra-high vacua with subsequent introduction of known gaseous impurities is stressed. A.E.D.Heylen

537.533

11106. THE BEHAVIOUR OF THE COMPOSITE EMITTERS OF SECONDARY ELECTRONS IN LONG LASTING OPERATION. E.G.Kormakova and V.G.Pavlovskaya. Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 505-12 (1958). In Russian. English summary : PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

In electron multipliers, oxygen—magnesium emitters have proved most suitable due to the high coefficient of secondary emission (σ = 8-10 for 300-400 eV impinging electrons) and the stability. Such emitters do not change their coefficient up to 600° C and operate in air provided no humidity is present. Results are reported on the above emitter activated in a simple way with alloys of Ag, Al, Cu and other metals. When activated by Al—Mg alloy and used as a thermocathode in multipliers, emission is 1-1.5 mA cm^{-2} for 60 eV bombarding electrons. The greatest emission change takes place after the joining up of emitters (30 min-2 h), after which change amounts to only a few percent after 6-8 h operation and depends mainly on the current density. Increase in velocity of primary electrons decreases stability. When used as a photocathode, the presence of caesium decreases the stability of pure oxygen—magnesium emitters. The dependence of stability on current density is more marked than for thermocathodes. In both modes of operation, stability is higher the lower the emission coefficient. If a high performance is required, operation of the device before measurement is recommended. A.E.D.Heylen

537.533

11107. SECONDARY EMISSION FROM COMPOSITE EMITTERS WITH HIGH COEFFICIENTS OF SECONDARY EMISSION. R.M.Aranovich and A.I.Pyatnitskii. Izv. Akad. Nauk SSSR,Ser. fiz., Vol. 22, No. 5, 518-27 (1958). In Russian. English summary: PB 141041T-S, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C. U.S.A.

Normal secondary emission is increased by an auto-electronic process. Such emitters formed by the evaporation of Mg in oxygen or the pulverization of finely dispersed MgO, have a high secondary coefficient ($\sim$ 80) and a low persistance of autoelectronic current in the audiofrequency range. However, they exhibit low operation stability and difficulty of working together with caesium photocathode. Emitters consisting of MgO layers formed by deposition of the carbonate on a nickel backing and annealing in a vacuum, were investigated. The ratio of variable component to toal current depends on the density and energy of the primary current, applied voltage etc. The non-variable component is attributed to autoelectrons from the dielectric; the variable component is due to true secondary electrons and direct emission from the metal backing without going through the dielectric. A.E.D.Heylen

537.533

11108. THE SECONDARY EMISSION PROPERTIES OF THE MAGNESIUM AND BERYLLIUM ALLOY EMITTERS AFTER SHORT ACTIVATION. V.L.Borisov and V.N.Lepeshinskaya. Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 534-45 (1958). In Russian. English summary : PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A new process for the preparation of Cu—Al—Mg, Cu—Si—Mg, Cu—Al—Be and Cu—Be secondary emitters dispenses with the usual introduction of oxygen for activation purposes. The method may also be applied to reactivate Cu—Mg emitters which have become partially deactivated by exposure to air. The highest secondary emission coefficients δ obtained were about 9-13; for a primary electron energy V_p of 100 eV δ was about 3.4 for Cu—Mg and 3.8 for Cu—Be alloys. The dependence of δ on V_p was investigated, and the energy spectrum of secondary electrons from each alloy is given. C.H.B.Mee

537.533

11109. THE PECULIARITIES OF VELOCITY DISTRIBUTION OF SECONDARY ELECTRONS ORIGINATING FROM METALLIC SURFACES COVERED WITH AN OXIDE FILM. M.L.Kapitsa. Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 557-60 (1958). In Russian. English summary: PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The energy spectrum of slow secondary electrons emitted from the surface of a metal is found to be dependent on the state of the

surface. It is possible to distinguish between oxide films and adsorbed gases on the metallic surface by means of the energy spectrum, and the method has been applied to the control of purity of such a surface. C.H.B.Mee

537.533

11110. SECONDARY EMISSION OF INSULATORS AND SEMICONDUCTORS. P.Pinard and M.Martineau.
J. Phys. Radium, Vol. 20, No. 5, 561-8 (May, 1959). In French.

The coefficient of secondary emission δ of insulators and semiconductors varies, as for metals, with the energy of the incident elcctrons, the crystalline state of the sample, the work function, and the angle of incidence of the primary electrons. But the poor conductivity of these substances gives rise to the phenomenon of "surface charge" whose influence on δ is considerable. Other factors (temperature, impurities, duration of bombardment, etc.) can also cause the coefficient of secondary emission to vary because they have, in particular, an influence on the surface charge.

537.533 : 539.1.07

11111. NEW PHOTO[ELECTRON]-MULTIPLIERS.
N.S.Khlebnikov.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 1, 70-7 (1958).
In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The development of new Russian types of photomultipliers, more suitable for scintillation applications than the ФЭУ – 19, is described. Details are given of the focusing system for electrons from the cathode on to the first dynode, and of the choice of an aluminium–magnesium alloy as a more stable dynode material than antimony–caesium. Two alternative dynode structures are used: the quadrant-box structure (similar to DuMont tubes) and the focused dynode system (similar to R.C.A. tubes). The characteristics and performance of types 1 С, 1Б , 1 В, 2 М and 2 Б are given. The photocathode diameters of these end-window photomultipliers range from 2.5 to 14.5 cm; they have 10-13 stages, and have resolving times from 50 down to 2 mμsec. The lines of future development include an increase in the number of stages, a fast multiplier with ring-shaped dynodes, and a fast multiplier with large photocathode. J.B.Birks

537.533

11112. SOME CHARACTERISTICS OF NEW INDUSTRIAL TYPES OF PHOTOMULTIPLIER. L.G.Leiteizen, A.G.Berkovskii, B.M.Glukhovskoi, O.S.Korol'kova and E.I.Tarasova.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 513-17 (1958). In Russian. English summary : PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Describes a number of photomultiplier types brought out in the years 1956-1957. These include a 13-stage one, another with resolving time of 10^{-9} to 10^{-10} sec, a miniature silver–bismuth one, and a large antimony–caesium one, the two latter being vibration-proof. Spectral characteristics and stability are discussed.
B.Meltzer

537.533 : 621.385.2

11113. PROPAGATION OF SPACE-CHARGE WAVES IN DIODES AND DRIFT SPACES. H.G.Kosmahl.
I.R.E. Trans Electron Devices, Vol. ED-6, No. 2, 225-31 (April, 1959).

It has generally been found that propagation of space-charge waves may be described (1) in space-charge-limited gaps by Gauss' hypergeometric functions; (2) in gaps with no space charge but with an accelerating homogeneous field by Bessel functions with real argument; and (3) in spaces free of d.c. fields by simple trigonometric functions. The equations derived become simpler through the selection of the d.c. velocity u, rather than the time t, as the independent variable.

537.533

11114. MAGNETIC FORCES BETWEEN MOVING CHARGES LEADING TO A LIMITATION IN BEAM DIAMETERS. J.M.Winwood.
J. Electronics and Control, Vol. 6, No. 3, 258-60 (March, 1959).

Argues, in opposition to Meltzer (Abstr. 7077 of 1959), that there is no limitation in low-velocity electron beam diameters because of a magnetic attraction of edge electrons by the rest of the beam.
B.Meltzer

537.533 : 621.385.833

11115. INVESTIGATIONS OF THE DIRECT-FOCUSING CATHODE DUE TO STEIGERWALD. F.W.Braucks.
Optik, Vol. 15, No. 4, 242-60 (April, 1958). In German.

The triode gun developed by Steigerwald [Abstr. 1877B of 1950; Optik, Vol. 5, 467-78 (Nov.-Dec., 1959)] is examined. The dependenc is discussed of control voltage, aperture, intensity (current density emitted into unit solid angle), position and diameter of the smallest cross-section of the beam on the design parameters of the system.

537.533

11116. BEHAVIOR OF INTENSE RELATIVISTIC ELECTRON BEAMS. R.H.Capps.
Phys. Rev., Vol. 114, No. 5, 1203-17 (June 1, 1959).

A theoretical investigation is made of intense, relativistic, partially neutralized, self-focusing electron beams. Approximate equations are derived that express the time derivatives of the beam radius and mean electron energy as functions of these parameters, the densities of the electrons, ions, and neutral atoms, and the impressed electric and magnetic fields. The equations are numerically integrated for various values of the parameters. It is shown that the radiation damping leads to a shrinkage of the beam radius to a value of order 0.05 m in a time of order 10^{-2}–10^{-1} sec. If the longitudinal electric field is constant the beam approaches the "equilibrium state" discussed by Budker (1956), in which the increase in electron transverse momentum caused by scattering from the ions is compensated by radiative loss, and the energy lost by radiation is restored by the longitudinal field. The various instability problems associated with dense systems of charged particles are not discussed.

537.533

11117. ELECTRON OPTICAL IMAGE [FORMATION] BY ORTHOGONAL SYSTEMS UNDER THE APPLICATION OF A NEW FIELD MODEL WITH EXACT ASSIGNABLE PARAXIAL PATHS. H.Dušek.
Optik, Vol. 16, No. 7, 419-45 (July, 1959). In German.

A rigorous solution of the orthogonal system of differential equations for paraxial electron paths and rectilinear axis is given for fields of non-rotational symmetry. The image properties of an orthogonal system and the asymptotic image formation by an arbitrary number of orthogonal systems are investigated. A detailed discussion of two-stage image formation is given in greater detail, and the possibility of an electrical correction of mechanical adjustment errors, as well as the combination of stigmator and projective are pointed out.

537.533

11118. THE REALIZATION OF MAGNETIC QUADRUPOLE LENSES WITHOUT IRON. A.Septier and G.Chartier.
C.R. Acad. Sci. (Paris), Vol. 249, No. 1, 64-6 (July 6, 1959).
In French.

The quadrupole components of the magnetic field of air-cored coils are calculated. The results suggest that it is possible to make strong quadrupole lenses without the use of an iron core.
A.E.I. Research Laboratory

537.533

11119. A SIMPLE METHOD FOR MAGNIFICATION DETERMINATION IN THE ELECTRON MICROSCOPE.
H.Römer and C.v. Fragstein.
Optik, Vol. 16, No. 6, 371-6 (June, 1959). In German.

A method is described which permits the determination to be made directly in two steps. The maximum error in the determinatio of the total magnification is around ±2.9%. The method takes care o the departures from optimum magnification due to the departures from optimum object position. The relationships between the change in object distance and the corresponding change in object magnification have been determined experimentally on a Siemens Ultramicroscope. The changes in magnification encountered in practice are discussed.

537.533 : 539.27

MAGNIFICATION CALIBRATION OF ELECTRON MICROSCOPE
See Abstr. 10307

537.533

11120. MAGNETIC SPECTROMETER HAVING INCLINED PLANE POLE-FACES FOR LOW-ENERGY ELECTRONS. S.Kato.
J. Phys. Soc. Japan, Vol. 13, No. 6, 544-8 (June, 1958).

The spectrometer was constructed for the velocity analysis of low-energy electrons. The magnetic field strength H at a point P satisfies $H = H_1/r$, where H_1 is a constant and r is the distance

rom the line of intersection of the two pole-planes to P. The nomentum dispersion of the spectrometer is about 3 times larger nd the solid angle of the collection is more than 10 times wider nan those of a conventional semi-circular spectrometer of similar imensions. The equation which determines the momentum dispersion is obtained and the conditions for focusing discussed.

537.533

1121. REFLECTION OF ELECTRONS AND EMISSION OF ECONDARY ELECTRONS FROM SOME METALLIC SURFACES IN HE RANGE OF LOW ENERGIES OF THE PRIMARY ELECTRONS. M.Bronshtein.
v. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 4, 441-7 (1958).
Russian. English summary: PB 141041T-4, obtainable from ffice of Technical Services, U.S. Dept. of Commerce, Washington, ashington, D.C., U.S.A.

The emission of secondary electrons from a number of metals as been studied using primary electrons with energies (E_p) in the ange 0.4-30 eV. A distinction was drawn between the true secondcy and the elastically and inelastically reflected electrons, the roportion of which is dependent on the primary electron energy. he electron reflection coefficient of the metal, it is postulated, is me function of the density of electron states within it. Graphs of eflection coefficient v. E_p are given and from these it was deduced at for tungsten, molybdenum and tantalum inelastically reflected rimary electrons occur for values of E_p between 3-3.5 eV, and true econdary electrons at higher values of E_p. W.G.Townsend

537.533

1122. ON THE PASSAGE OF ELECTRONS THROUGH THIN LASS FILMS. A.I.Pyatnitskii.
v. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 4, 456-63 (1958).
Russian. English summary: PB 141041T-4, obtainable from ffice of Technical Service, U.S. Dept. of Commerce, Washington, .C., U.S.A.

The proportions of electrons transmitted and reflected by thin ass films were measured for incident energies up to 30 kV. The roportion transmitted is small below 20 kV, the major part of the eam being absorbed. There are hysteresis effects depending on lm thickness and conductivity in the curves of transmitted intensity gainst voltage; these effects are less marked for the thinner films, thickness about 0.15 μ. J.Hawgood

537.533

1123. INVESTIGATION OF DISCRETE ELECTRON ENERGY OSSES IN Mg, MgO, BeO and Ge. N.B.Gornyĭ.
v. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 475-85 (1958).
Russian. English summary: PB 141041T-5, obtainable from ffice of Technical Services, U.S. Dept. of Commerce, Washington, .C., U.S.A.

The losses of reflected electrons and the distribution of true econdary electrons on bombardment of the above materials with ow (~ 100 eV) electrons were simultaneously investigated by the ectric differentiation method. Losses are conditioned by intere transitions; for the higher energy impinging electrons, losses ree with the formula given, but for lower energy (2-5 eV), the ove law is not obeyed. A.E.D.Heylen

537.533 : 548.74

ELECTRON-OPTICAL IMAGING OF CRYSTAL LATTICES. ee Abstr. 10394

537.533 : 537.311.33

124. RESONANCE POTENTIALS IN THIN FILMS OF POTASUM CHLORIDE. H.Jacobs, I.N.Greenberg, L.Goble and A.Ramsa. miconductors and phosphors. See Abstr. 9597. pp. 413-25.

The absorption and backscattering of slow electrons by KCl ms was studied as a function of electron energy. Three different perimental structures were used: a triode with a rotating dynode, device where the electron beam described a cycloid path, and a be using a magnetic velocity analyser. Absorption occurred at 5 eV and 7.2 eV, and a threshold of secondary emission near 2 eV. These energies correlate with the decomposition energy of Cl, the exciton energy level in KCl, and the optical energy gap, spectively. In addition new effects, not yet interpreted, were served, corresponding to discontinuities at various energies from 4 to 11.5 eV. J.B.Birks

537.533 : 539.27

11125. ELECTRON SCATTERING AND IMAGE CONTRAST IN ELECTRON MICROSCOPY. P.Sadhukhan.
Indian J. Phys., Vol. 32, No. 5, 249-58 (May, 1958).

The elastic scattering cross-sections for a 60 kV electron beam are calculated for several different elements from the equations of Moliere (Abstr. 3225 of 1947) and Lenz (Abstr. 7490 of 1954). The variation of the scattering cross-section with the aperture angle and with the beam voltage is considered. The inelastic scattering cross-sections for the same elements have also been estimated from Lenz's equations. The values of different cross-sections have been compared and their relative importance in the production of contrast in an electron microscopic image has been estimated.

537.533

11126. SCATTERING OF ELECTRONS BY CARBON FILMS. Y.Kamiya.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1144-51 (Oct., 1958).

The intensity distribution of electrons scattered by carbon films was measured by the photographic method using a sector camera. The absolute intensity was obtained by the use of an intensity scale. The angular range of the measurement was 1.0×10^{-2} to 1.2×10^{-1} rad., the thickness of films 350-4400 A and the accelerating voltage 47 kV. Results of the measurement were in fair agreement with the theory of Lenz (Abstr. 7490 of 1954). For detailed agreement, however, a smaller atomic radius than that of Lenz must be taken and the inter-atomic interference effect must also be taken into account.

537.533

11127. ELECTRON CHARACTERISTIC ENERGY LOSSES IN SOME INTERMETALLIC COMPOUNDS. B.Gauthe.
Phys. Rev., Vol. 114, No. 5, 1265-8 (June 1, 1959).

Measurements were made of the characteristic energy losses of 30 keV electrons in transmission through thin films of indium, indium antimonide, cadmium telluride, and zinc telluride; for comparison, the electron energy losses in antimony, cadmium, tellurium, and zinc were reinvestigated. The energy loss spectra in these intermetallic compounds appear significantly different from a simple superposition or average of the energy loss spectra of the component metals. Some detailed interpretations of the characteristic energy losses in In and InSb are suggested.

537.533 : 523.852

11128. THE POLARIZATION OF SYNCHROTRON RADIATION. K.C.Westfold.
Astrophys. J., Vol. 130, No. 1, 241-58 (July, 1959).

The spectral distribution and polarization of radiation from an electron gyrating ultra-relativistically in a magnetic field are calculated. The result is used to calculate the principal emissivities of a distribution of high-energy electrons such as occurs in the Crab Nebula. It is shown that the degree of polarization of the emission increases with frequency, from two-thirds at radio frequencies to unity. The depolarizing factors affecting the intensity of the emergent rays are briefly discussed.

537.533

11129. THE KINETICS OF THE CHARGE ACCUMULATION BY THE SURFACE OF DIELECTRICS DURING IRRADIATION BY AN ELECTRON BEAM. I.R.Zakirova and S.A.Fridrikhov.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 546-56 (1958).
In Russian. English summary: PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A new pulse method has been developed to study the kinetics of the formation of charge on a dielectric surface under electron bombardment. It is found that after a certain bombardment time the field due to the accumulated charge on the dielectric causes a decrease in the rate of charging, and the dielectric cannot reach the collector potential during the period of the quasi-steady state, t_{qs}. After the quasi-steady state, charge accumulation is very slow and is very sensitive to target leakage. The period τ during which the secondary emission diminishes is found to be proportional to the collector field; further, τ and t_{qs} are independent of the energy of the primary electrons. C.H.B.Mee

ION EMISSION . ION BEAMS

537.534 : 541.183

11130. ADSORPTION AND DIFFUSION OF INERT GASES ON TUNGSTEN. R.Gomer.
J. chem. Phys., Vol. 29, No. 2, 441-2 (Aug., 1958).

For background, see Abstr. 8060 (1958). Experimental evidence of multilayer adsorption is presented. Instability for layers beyond the fourth is often observed. Relevant numerical data are given.
A.H.W.Beck

537.534

11131. SCATTERING LENGTHS OF INERT GASES FOR ELECTRONS OF NEGATIVE ENERGY. FIELD EMISSION THROUGH DIELECTRICS. R.Gomer.
J. chem. Phys., Vol. 29, No. 2, 443-4 (Aug., 1958).

See preceding abstract. Discusses apparent work function as measured by Fowler–Nordheim plots for clean and covered tips. Four effects are treated: (1) decrease of the average field by the dielectric layer; (2) decrease of image potential; (3) change in electronic potential energy by polarization in the dielectric; (4) the presence of holes in the barrier effectively reduces the work function.
A.H.W.Beck

537.534 : 541.183

11132. FIELD DESORPTION. R. Gomer.
J. chem. Phys., Vol. 31, No. 2, 341-5 (Aug., 1959).

A theory of field desorption covering both covalent and ionic binding is presented. The mechanism corresponds to field ionization preceded by complete or partial ordinary desorption in the former and to direct ionic evaporation in the latter case. Comparison with experiment shows that field desorption of Ba can proceed via Ba^{+} or Ba^{+2}. It is pointed out that field desorption could be used to investigate the shapes of potential curves in adsorption.

537.534

11133. HIGH-ENERGY METHYL IONS FROM PROPANE UNDER ELECTRON IMPACT. H.E.Stanton.
J. chem. Phys., Vol. 30, No. 4, 1116-17 (April, 1959).

The energy distribution curves of positive ions of masses 15 and 29, produced from propane by the impact of electrons of energy about 70 eV, are given. The curve for 15^{+} ions shows maxima at nearly zero energy and at about 2 eV, whereas that for 29^{+} ions shows only the maximum at nearly zero energy; the appearance potential of the higher energy group of 15^{+} ions is about 30 to 33 eV. These results are briefly discussed in relation to the mechanism of the production of the ions.
J.Dutton

537.534

11134. A POWERFUL SOURCE FOR ION AND ELECTRON BEAMS. H.Fröhlich.
Nukleonik, Vol. 1, No. 5, 183-8 (April, 1959). In German.

Describes a source of electrons or ions for use with linear accelerators and similar devices where large currents are required. A sintered Ni, Ba, Sr cathode is employed in conjunction with a combined electrostatic-magnetic lens system. Continuous electron currents of 7.5 A and hydrogen ion currents of 1 A are possible. Much higher currents are available under pulse operation.
A.E.I. Research Laboratory

537.534

11135. ION CONFINEMENT BY ROTATION IN MAGNETIC MIRROR GEOMETRY. C.L.Longmire, D.E.Nagle and F.L.Ribe.
Phys. Rev., Vol. 114, No. 5, 1187-91 (June 1, 1959).

When a generally radial electric field is imposed upon a mirror magnetic field configuration, the resulting system has an increased ability to contain plasma between the mirror regions. The motion of the ions consists of a drift around the axis of symmetry upon which is superimposed a spiralling motion. The guiding centre motion departs from the direction of magnetic flux surfaces. An adiabatic invariant is derived for the drift component of the motion, and an expression is derived for the mirror enhancement brought about by the $E \times B$ drift. The departure of the guiding centre of a particle from a flux surface and the energy balance of its secular motion are calculated by using the adiabatic invariant.

537.534

11136. MASS-SPECTROGRAPHS WITH ABERRATION CORRECTIONS. L.A.König and H.Hintenberger.
Nuclear Instrum., Vol. 3, No. 3, 133-48 (Sept., 1958). In German.

The general expressions derived previously (Abstr. 1537 of 1959) for second-order angle aberration, angle-velocity aberration, and velocity aberration of mass spectrometers consisting of a radial electric field and a homogeneous magnetic sector field in series, are developed for the special case of mass spectrographs with double focusing of the first order for all masses along a straight image curve. The possibilities of correcting these image defects are investigated. Tables are presented of solutions for apparatus types in which at one point of the image curve all three or two of the image defects simultaneously vanish. Almost all types of apparatus with simultaneous correction of the three image defects possess a large radial field. On the other hand there are useful solutions according to which either the two image defects depending on aperture or the two depending on velocity vanish. The numerical calculations were carried out by means of an IBM-650 computer. The computation procedure is outlined briefly.

537.534 : 539.18 : 538.1 : 621.318.2

PERMANENT MAGNET FOR ATOMIC BEAM FOCUSING.
See Abstr. 9750

PARTICLE ACCELERATORS

537.54

11137. 150 kV COCKROFT–WALTON TYPE PARTICLE ACCELERATOR. C.S.Khuran and H.S.Hans.
Indian J. Phys., Vol. 32, No. 10, 468-72 (Oct., 1958).

Describes the Cockroft–Walton type particle accelerator at the Muslim University, Aligarh, India. It uses a radio-frequency ion-source and a 250 kV isolation transformer for supplying voltage to the various circuits in the ion-source head. A steady current of protons of more than 100 μA at the target has been obtained.

537.54 : 621.384.6

11138. TEST OF A PORCELAIN INSULATOR FOR USE IN AN ELECTROSTATIC STRONG-FOCUSING LENS FOR LINEAR PARTICLE ACCELERATORS. L.A.Dushin and V.A.Maslov.
Zh. tekh. Fiz., Vol. 28, No. 8, 1837-8 (1958). In Russian.
English translation in: Soviet Physics–Technical Physics (New York), Vol. 3, No. 8, 1694-5 (Aug., 1958).

With an interelectrode distance of 7 mm at 2 to 4×10^{-6} mm Hg the lens could withstand 100 kV with 2.3 breakdowns per minute provided the electrodes had been aged previously at lower voltages to outgas them.
J.W.Sturges

537.54 : 539.1

11139. PRODUCTION OF ELEMENTARY PARTICLES IN THE LABORATORY. W.Paul.
Naturwissenschaften, Vol. 46, No. 9, 277-83 (1959). In German.

Reviews briefly the principles and construction of cyclic accelerators, and describes the use of such machines for the production of mesons, hyperons and antinucleons.
S.J.St-Lorar

537.5

11140. CONCERNING THE INFLUENCE OF RADIATION IN CYCLICAL ACCELERATORS. A.A.Kolomenski and A.N.Lebedev.
Nuovo Cimento, Vol. 11, No. 3, 458-60 (Feb. 1, 1959).

The authors consider to be erroneous a treatment of radiation damping by Matveev (Abstr. 1086 of 1958) which questions the validity of their previous work (Abstr. 4060 of 1958). The alleged errors are discussed in detail.
A.E.I. Research Laborator

537.54 : 621.384.61

11141. ON THE THEORY OF THE FOCUSING PROCESS IN ACCELERATORS WITH MAGNETIC FIELD PERIODIC IN THE AZIMUTH. Yu.V.Vandakurov.
Zh. tekh. Fiz., Vol. 28, No. 11, 2567-82 (1958). In Russian.

A generalization of a method developed previously (Abstr. 7091 of 1958) is applied to find the approximate solution of the differential equations of the trajectories, when some limitations are imposed upon the shape of the field. In particular it is assumed that the ratio of the mean radius of the equilibrium orbit to its radius of curvature is small with respect to the number of the elements of periodicity, and that the mean radius of the orbit is close to that circle which would be the orbit in the field averaged along the azimuth. Formulae are obtained for the equilibrium orbits and for the frequency of betatron oscillations. Various types of fields are considered.
G.Martell

537.54

11142. A COMPARATIVE STUDY OF BETATRON AND DIRECT INJECTION IN THE ELECTRON SYNCHROTRON PROPOSED FOR THE INSTITUTE OF NUCLEAR PHYSICS, CALCUTTA. M.N.Viswesvariah and S.K.Sen.
Indian J. Phys., Vol. 32, No. 2, 66-74 (Feb., 1958).

The operation of an electron synchrotron in relation to the types of injection is described briefly, and the capture efficiency at the time of start of the synchrotron phase of motion has been calculated. In the two cases the approach of calculation has been different depending on the fact that the motion of electrons towards the end of the betatron phase and the motion at the time of injection from the external injector are different. The merits of the two types of injection are discussed.

537.54

11143. OPERATION AT 1000 MeV OF THE FRASCATI ELECTRO-SYNCHROTRON. A.Alberigi, F.Amman, C.Bernardini, U.Bizzari, G.Bologna, G.Corazza, G.Diambrini, G.Ghigo, A.Massarotti, G.P.Murtas, M.Puglisi, I.F.Quercia, R.Querzoli, G.Sacerdoti, G.Salvini, G.Sanna, P.G.Sona, R.Toschi, A.Turrin, M.Ageno and E.Persico.
Nuovo Cimento, Vol. 11, No. 2, 311-12 (Jan. 16, 1959).

This electron synchrotron has operated with maximum beam energy 1000 MeV, at a repetition rate of 20 p.p.s., with peak magnetic field of 9260 gauss. Bremsstrahlung γ-rays are obtained from a fixed target in 1 msec pulses, the average output being 3×10^{10} quanta/min. Characteristics of the machine are given.
J.H.Fremlin

537.54 : 539.12

CALORIMETRIC MEASUREMENTS OF A SYNCHROTRON γ-RAY FLUX. See Abstr. 9928

537.54

11144. STOCHASTIC ACCELERATION IN A 5 MeV CYCLOTRON. R.Keller, L. Dick and M.Fidecaro.
C.R. Acad. Sci. (Paris), Vol. 248, No. 22, 3154-6 (June 1, 1959).

Like a synchrocylcotron, except that h.f. supply to the dee does not have a frequency programme but contains a continuous spectrum of frequencies unrelated in phase. Beam intensity is intermediate between cyclotron and synchrocyclotron, and beam is continuous. The stochastic acceleration principle is outlined.
J.W.Sturgess

537.54

11145. EQUATIONS FOR THE ION MOTION IN A FIXED FREQUENCY CYCLOTRON. M.Konrad.
Period. math.-phys. astron. (Zagreb), Vol. 11, No. 3-4, 253-62 (1956).

Theoretical attempt to find the solution of the equations for horizontal ion motion in a cyclotron in general form without simplifying assumptions.
J.W.Sturgess

537.54

11146. OPERATION OF A RADIAL SECTOR FIXED-FREQUENCY PROTON CYCLOTRON. F.A.Heyn and Khoe Kong Tat.
Rev. sci. Instrum., Vol. 29, No. 7, 662 (July, 1958).

Successful operation of a cyclotron with azimuthally variable magnetic field is reported. With the very low dee voltages permissible, considerable design simplification is possible.
T.O.Jeffries

537.54

11147. THE OMEGATRON. N.I.Leont'ev and Yu.K.Udovichenko.
Pribory i Tekh. Eksper., 1959, No. 1, 101-5 (Jan.-Feb.).
In Russian.

An omegatron is described for use with light gases. An accuracy of 5% is obtained for neon.
T.Mulvey

537.54

11148. OPERATION OF A SPIRAL SECTOR FIXED FIELD ALTERNATING GRADIENT ACCELERATOR. D.W.Kerst, H.J.Hausman, R.O.Haxby, L.J.Laslett, F.E.Mills, T.Ohkawa, F.L.Peterson, A.M.Sessler, J.N.Snyder and W.A.Wallenmeyer.
Rev. sci. Instrum., Vol. 28, No. 11, 970-1 (Nov., 1957).

The successful operation of a model spiral sector accelerator is reported. The unidirectional magnetic field gives a smaller orbit diameter than in a radial sector machine, the alternation of gradient being achieved by the edge focusing of the spiral sectors. By a conservative choice of parameters, structural simplicity was achieved without eliminating the non-linearity difficulties which must be faced. Detailed calculations of particle orbits were made on digital computers and reasonable agreement with measurements obtained. Preliminary results are quoted.
T.O.Jeffries

IONIZATION . PLASMA

537.56

11149. A NEW PROBE METHOD FOR MEASURING IONIZED GASES. T.Okuda and K.Yamamoto.
J. Phys. Soc. Japan, Vol. 13, No. 4, 411-18 (April, 1958).

The method is based upon the idea that the end of a cylindrical probe affects the surface area of the sheath. The first stage of this method is to measure the sheath radius by using a variable-length structure. The procedure is to extrapolate the probe current to $l = 0$ along the straight line of the plot of current versus length of probe and to measure the slope of the straight line and thus to derive the radius of the sheath. Experimental results of ion sheath for A are fairly consistent with the theoretical radius expected from simple theories, except for low plasma density. The discrepancy between the theory and the experiment is caused by the disturbance. By taking into account a correction factor, namely, depletion in ion collection due to elastic scattering, plasma density can be exactly estimated by measuring the radius of the ion sheath without having any knowledge of the space charge equation. Thus, the reliability of the probe method is increased.

537.56

11150. THE IONIZATION AND DISSOCIATION OF OXYGEN BY ELECTRON IMPACT. D.C.Frost and C.A.McDowell.
J. Amer. Chem. Soc., Vol. 80, No. 23, 6183-7 (Dec. 5, 1958).

The ionization and dissociation of molecular oxygen has been studied using the retarding potential difference (r.p.d.) method of obtaining essentially mono-energetic electrons. All the spectroscopically known excited states of molecular oxygen ($^2\Pi_g$, $^4\Pi_u$, $^2\Pi_u$, $^4\Sigma_g^-$), and one additional state, were observed. The vertical ionization potentials here determined are in very good agreement with those calculated from available spectroscopic data. Six different dissociation processes leading to the production of O^+ ions were observed. These ions arise from either of these two types of process:

$$O_2 + e = O^+ + O + 2e \quad (a),$$

$$O_2 + e = O^+ + O^- + e \quad (b).$$

Each particular process has been identified by a careful study of the negative and positive ions formed. Ambiguities in earlier work, which arose largely from the difficulty of calibrating the negative ion energy scale, have been overcome by using sulphur hexafluoride as a calibrating gas.

537.56

11151. IONIZATION AND DISSOCIATION BY ELECTRON IMPACT IN FLUORINE, HYDROGEN FLUORIDE, CHLORINE AND HYDROGEN CHLORIDE. R.Thorburn.
Proc. Phys. Soc., Vol. 73, Pt 1, 122-6 (Jan., 1959).

Gives appearance potentials for positive and negative ions, from which certain ionization potentials, e.g. of F_2, Cl_2 etc. were derived. Only in F_2 and Cl_2 were negative ions formed by the ion-pair process. A mass spectrometer with a special gas inlet and source system was used.
J.D.Craggs

537.56

11152. THE DESCRIPTION OF THE EJECTED ELECTRONS IN K-SHELL IONIZATION. A.M.Arthurs.
Proc. Phys. Soc., Vol. 73, Pt 4, 681-4 (April, 1959).

Calculations of the cross-section, for various energies of the incident particle, are made using the Stobbe—Massey—Mohr description of the ejected electron (usual for electron and photon impact calculation), and compared with the results of using Bethe's description (usual for nuclear impact). When screening by the outer electrons is taken into account, the discrepancy is appreciable for the high energies; the S.M.M. results seem better.
J.Hawgood

537.56

11153. IONIZATION OF AIR BY H^+ AND H_2^+ IONS.
R.N.Il'in, V.V.Afrosimov and N.V.Fedorenko.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 41-8 (1959). In Russian.

The composition was studied of the secondary ions produced in

single collisions between 5-180 keV H^+ and H_2^+ ions and air molecules. The following secondary ions were detected: N_2^+, O_2^+, N^+, O^+, N^{++}, O^{++}, A^+. The cross-sections for secondary-ion formation, the cross-section for electron capture by H^+ and H_2^+ ions, and the total cross-section for ionization of air were measured.

537.56

11154. MEASUREMENT OF THE ATTACHMENT OF SLOW ELECTRONS IN OXYGEN. L.M.Chanin, A.V.Phelps and M.A.Biondi.
Phys. Rev. Letters, Vol. 2, No. 8, 344-6 (April 15, 1959).

A brief preliminary note on drift tube measurements of attachment coefficients in oxygen. A two-body process appears to be operative for mean electron energies > about 1.3 eV. Below this energy a pressure dependence was found in pure O_2, indicating a three-body process. Data obtained by the microwave method are also discussed.
J.D.Craggs

537.56

11155. ON THE COEFFICIENTS OF IRREVERSIBLE PROCESSES IN A HIGHLY IONIZED GAS. T.Kihara.
J. Phys. Soc. Japan, Vol. 14, No. 4, 402-10 (April, 1959).

An effective interparticle potential, which is a modified Debye–Hückel potential, is introduced and discussed in order to eliminate simultaneous interactions between three particles or more in an ionized gas. For this potential weak-interaction asymptotes of collision cross-sections necessary for the theory of irreversible processes are calculated without making further approximations. These cross-sections are applied to relaxation between ion and electron temperatures and to the coefficient of viscosity.

537.56

11156. THE REACTION $He_2^+ + Ne \rightarrow Ne^+ + 2\,He$ IN THE POSITIVE COLUMN. M.Pahl and U.Weimer.
Z. Naturforsch., Vol. 13a, No. 1, 50-1 (Jan., 1958). In German.

The cross-section for this reaction and the concurrent ones has been measured and is given for various Ne concentrations of the mixture.
G.Martelli

537.56

11157. FOURIER ANALYSIS OF THE ELECTRIC MICRO-FIELD IN A PLASMA. I. G.Hettner and H.Wagner.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 89-95 (1959). In German.

Harmonic statistical analysis of the variation with time of an arbitrary component of the electric field in a plasma. Interactions between ions and electrons are neglected. The Fourier amplitudes are found to have a Gaussian distribution, and the most probable spectrum is obtained.
B.Meltzer

537.56

11158. VELOCITY CHANGES OF CHARGED PARTICLES IN A PLASMA. F.D.Kahn.
Astrophys. J., Vol. 129, No. 2, 468-74 (March, 1959).

A comparison is made of the different ways in which an ionized gas may change the velocities of fast-moving protons. It is found that a beam with a very well-defined velocity may lose its kinetic energy through the excitation of unstable oscillators, but it seems most unlikely that the stringent conditions necessary for this process will ever occur in any astrophysical application. Single protons lose energy by leaving a wake in the plasma (Pines and Bohm 1952). If sufficiently intense plasma oscillations are excited, the protons may also gain energy through acceleration in random electric fields. Fast electrons can be accelerated even more efficiently in this way.

537.56

11159. PLASMA OSCILLATIONS. K.M.Case.
Ann. Phys. (New York), Vol. 7, No. 3, 349-64 (July, 1959).

The equivalence of the Landau (Abstr. 353 of 1947) and of van Kampen (Abstr. 3042 of 1956) treatments of the initial value problem for plasma oscillations is demonstrated. Using completeness and orthogonality theorems for the normal modes, an integral representation for the solution of the initial value problem is obtained which is shown to be identical with that obtained by modifying the integration contour in Landau's Laplace transform solution.

537.56

11160. A METHOD OF DETECTING NON-IONIZING SHOCK WAVES AND THE USE OF RADIO WAVES FOR THEIR STUDY. R. der Agobian.
C.R. Acad. Sci. (Paris), Vol. 248, No. 9, 1308-11 (March 2, 1959). In French.

Briefly describes, with appropriate diagrams and oscillograms, a technique for studying the propagation of "fairly weak" shocks through a pre-ionized plasma, which involves the measurement of microwave (3 cm wavelength) radiation interaction with the plasma.
J.D.Craggs

537.56

11161. THE COOLING OF A GAS OF CHARGED PARTICLES IN A FULLY IONIZED PLASMA. A.Brin, J.L.Delcroix and J.Salmon.
J. Phys. Radium, Vol. 20, No. 5, 529-34 (May, 1959). In French.

This is studied following the assumptions of Rosenbluth, MacDonald and Judd. The gas concentration is assumed low compared with the concentration of plasma particles. In these cases, the process obeys a derivate equation. This equation is linear, so that the method of eigenfunctions and eigenvalues is suitable, and it is possible to define relaxation times. In a particularly important case, the characteristic deviations, and relaxation times can be obtained in detail. A comparison is made with the results of Spitzer.

537.56 : 532.5 : 538.

11162. IONIC THEORY OF PLASMAS AND MAGNETOHYDRODYNAMICS. H.S.Green.
Phys. of Fluids, Vol. 2, No. 4, 341-9 (July-Aug., 1959).

This paper aims at removing certain sources of confusion in plasma theory by deriving a complete set of macroscopic equations based on the ionic theory. Relativistic and quantum effects are usually neglected, and an approximation equivalent to that of the macroscopic theory of irreversible processes is adopted. But there is no other approximation, and in particular multiple interactions are fully accounted for. The theory of the dielectric constant and permeability of plasmas is sketched, and there follows an ionic derivation of the equations of continuity, and of energy and momentum transport, based on an exact separation of the long-range and short-range forces. It is shown how the short-range forces contribute to the pressure, the energy flux, and the flux of entropy. The ionic basis of the theory of irreversible processes is discussed, and its relevance to the generalization of Ohm's law. In an appendix, the formal statistical thermodynamics of plasmas is developed in a way which avoids certain difficulties associated with the long-range interactions.

537.56

11163. MULTISTAGE MAGNETIC COMPRESSION OF HIGHLY IONIZED PLASMA. F.H.Coensgen, W.F.Cummins and A.E.Sherman
Phys. of Fluids, Vol. 2, No. 4, 350-61 (July-Aug., 1959).

The mean energy of the charged particles of a plasma which is confined in a magnetic field may be increased by increasing the magnitude of the magnetic field in a time which is short with respect to the ion relaxation time (magnetic compression). It is shown that the necessary stored energy can be reduced and the efficiency greatly increased if the magnetic compression is performed in several stages, such that the plasma is compressed and transferred to successively smaller volumes. The predicted transfer behaviour was confirmed by studying the plasma movement in a three-stage system. In the course of the investigation a plasma source was developed which provides bursts of plasma of 10^{16} to 10^{18} ions with an average velocity of the order of 10^7 cm/sec.

537.56 : 538.561

11164. CYCLOTRON RADIATION FROM MAGNETICALLY CONFINED PLASMAS. D.B.Beard.
Phys. of Fluids, Vol. 2, No. 4, 379-89 (July-Aug., 1959).

The cyclotron emission from a hot, completely ionized, magnetically confined plasma was estimated by computing the absorption of an incident plane wave. The harmonics of the fundamental cyclotron frequency, which are emitted perpendicular to the magnetic field direction, were summed over and also treated individually. Because of the Doppler effect and the relativistic variation in mass the behaviour of the electrons and the electromagnetic properties of the medium are functions of electron velocity. Assuming a Maxwell–Boltzmann distribution in electron velocity, the polarization of the plasma was computed by integrating over electron velocity. Solution of Maxwell's equations yielded the absorption of an incident wave, and thus, from Kirchhoff's relation, the emission of the plasma was determined. The entire calculation was carried out nonrelativistically to the first order in v^2/c^2, and at temperatures too low for fluctuations to play a dominant role.

537.56

11165. ON THE BEHAVIOR OF PLASMA AT IONIC RESONANCE. P.H.Doyle and J.Neufeld.
Phys. of Fluids, Vol. 2, No. 4, 390-2 (July-Aug., 1959).

An electromagnetic wave having its wave vector parallel to the

irection of the steady magnetic field is attenuated in plasma very ffectively when the frequency ω is equal to the ionic resonance fre- uency Ω_g of the plasma. A small localized periodic disturbance nitiated in a plasma in thermodynamic equilibrium at $t = -\infty$ and aving frequency $\omega = \Omega_g$ produces along the direction of the magnetic eld a wave motion characterized by a complex wave vector $\sim (\Omega_0\Omega_g/c^2u_{oi})^{1/3}(\sqrt{3} + i)$ where Ω_0 is the Langmuir frequency and $_{oi}$ is the mean thermal velocity of the ions in the plasma. The ttenuation per wavelength at the resonance frequency is substantial nce Imk/Rek = $1/\sqrt{3}$. However, the attenuation per unit of length not at maximum at ionic resonance since it increases for increas- g frequencies when ω passes through the resonance. This is shown the fact that for $\omega = \Omega_g$, $\mathrm{Im}(dk/d\omega) > 0$ since at resonance $\mathrm{n}(dk/d\omega) = K_1/u_{oi} + (K_2/u_0^2u_{i0})^{1/3}$ where K_1 and K_2 are appropriate ositive constants and u_0 is the velocity of the magnetohydrodynamic ave.

537.56

1166. IMPROVEMENTS IN THE MICROWAVE PROPAGATION ETHOD OF STUDYING DECAYING GAS PLASMAS.
Takeda and E.H.Holt.
ev. sci. Instrum., Vol. 30, No. 8, 722-5 (Aug., 1959).

Some improvements in measuring the transient values of the ectron density in decaying gas plasmas by the propagation method re described. The electron density, as is known, can be calculated om measurements of phase shift and attenuation of a probing icrowave signal propagated through the plasma. The increase of e detection sensitivity of very small phase shifts (X-band micro- ave) leads to at least a tenfold decrease in electron density meas- rement. Thus, in a 10 in. long discharge tube densities of 10^{11}–10^8 n^{-3} are measured, which is comparable to that by the cavity ethod at the same frequency.

537.56

1167. PLASMA CONFIGURATIONS WITH SURFACE CURRENTS, HICH ARE IN EQUILIBRIUM WITH A [EXTERIOR] MAGNETIC IELD. R.Kippenhahn.
. Naturforsch., Vol. 13a, No. 4, 260-7 (April, 1958). In German.

Configurations of a plasma having constant pressure are xamined. With the aid of an existence-theorem from the theory partial differential equations, the question of the existence of uch configurations is reduced to differential-geometrical proper- es of the surface of the plasma. These properties are then invest- ated for the torus of circular cross-section with an interior zimuthal magnetic field and for a surface of axial symmetry with ariable diameter. A torus of variable cross-section is treated pproximately.

537.56

1168. COMPARISON OF THE DECAY RATES OF PLASMA IN YDROGEN AND DEUTERIUM.
.I.Glotova, V.L.Granovskii and V.I.Savoskin.
h. eksper. teor. Fiz., Vol. 35, No. 6(12), 1380-5 (1958). In Russian.

The deionization rate in hydrogen and deuterium, at pressures = 15 – 600 μ Hg, tube diameters d = 3.2 – 6.5 cm and values of e initial current of I_0 = 60 – 1500 mA, was studied with help of scillography of the ion current recorded with a negative probe. nder the conditions employed, the relative deionization rate in and D decreased with time. The pressure dependence of the rate the process is not a monotonous function and passes through a aximum at pd $\cong 10^{-1}$ – 1 mm Hg. The ratio of the deionization "time constants" (initial as well as final) in deuterium and hydrogen τ_D/τ_H, is close to 1.4, i.e. $\cong \sqrt{m_D/m_H}$ for all pressures under iffusion conditions ($p < p_m$), as well as under recombination onditions ($p > p_m$). The latter signifies that, under these conditions olume recombination mainly occurs in triple collisions with neutral olecules ($M^+ + e + M$).

537.56

1169. PLASMA ACCELERATION. I.S.Shpigel'.
h. eksper. teor. Fiz., Vol. 36, No. 2, 411-15 (1959). In Russian.

A plasma has been accelerated in vacuum in an axially- ymmetric, inhomogeneous, pulsed magnetic field. The density of e plasma clusters exceeded 10^{12} particles/cm^3. The peak energy nitrogen and oxygen atomic ions was ~ 190 eV, of helium ions 280 eV and of hydrogen atomic ions ~ 120 eV.

537.56 : 538.566

SLOW-WAVE PROPAGATION IN ELECTRON PLASMAS WITH UNCOMPENSATED SPACE CHARGE. See Abstr. 9886

COSMIC RAYS

537.591 : 535.33

11170. NOTES ON THE $L\beta_2$ EMISSION AND THE L_{III} ABSORPTION OF MOLYBDENUM (42). P.Callon.
C.R. Acad. Sci. (Paris), Vol. 248, No. 14, 2085-6 (April 6, 1959). In French.

Results of spectroscopic measurements indicate that the asymmetry of the $L\beta_2$ line is not due solely to an absorption effect.

A.R.Stokes

537.591 : 550.38 : 523.75

11171. SOLAR CONTROL OF SOME UNUSUALLY REMARKABLE GEOPHYSICAL EVENTS. S.L.Malurkar.
J. sci. industr. Res., Vol. 17A, No. 12 (Suppl.), 69-71 (Dec., 1958).

From a discussion of geomagnetic and cosmic-ray effects associated with five outstanding solar events in the period, 1942-1956, it appears that, (i), the position of the active region on the solar disk is important in the initiation of a major geophysical event; (ii), only solar flares occurring within persistently active regions produce cosmic-ray events; (iii), cosmic-ray bursts appear to be selectively linked with active flares near the W limb of the sun.

D.R.Barber

537.591

11172. ELEMENTARY PARTICLES IN COSMIC RADIATION. E.Schopper.
Naturwissenschaften, Vol. 46, No. 9, 290-5 (1959). In German.

A review article describing the discovery and properties of particles detected in cosmic radiation. A brief survey of experimental techniques is given.

S.J.St-Lorant

537.591.1

11173. HIGH-ENERGY NEUTRONS IN COSMIC RAYS.
G.N.Flerov, V.I.Kalashnikova, A.V.Podgurskaya, E.D.Vorob'ev and G.A.Stolyarov.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 727-34 (1959). In Russian.

Multi-layered ionization chambers were employed to detect the effect of heavy nuclei fission in cosmic rays. The altitude dependence of fission was investigated, as well as the angular distribution of the fission producing particles. The energy and momentum of the latter have been estimated. It is shown that, in the overwhelming majority of cases, fission of heavy nuclei is caused by the nucleon component of the cosmic radiation.

537.591.15

11174. AN EXPERIMENTAL STUDY OF EXTENSIVE AIR SHOWERS. S.Miyake, K.Hinotani, T.Kaneko and I.Katsumata.
J. Phys. Soc. Japan, Vol. 13, No. 8, 782-93 (Aug., 1958).

Observations were made at Mt Norikura (2840 m above sea level and 25°N geomagnetic latitude), using two multiplate cloud chambers, 90 sparsely distributed G.M. counters and two sets of counter hodoscope piles. The structure of the air shower in the neighbourhood of the shower axis was mainly investigated. For each observed shower, the shower size N and the location of the shower axis were estimated. The showers were divided into three groups characterized by the core structure, which depends upon the shower size. The first group comprises the small size shower (less than 1.5×10^5), which has a comparatively poor core that fluctuates due to the behaviour of a few high energy particles. The second group comprises the middle size shower (1.5×10^5 – 5.5×10^5), in which the decaying nuclear component and the electron component are in a state of equilibrium, and the electron-component lateral-distribution is proportional to $1/r$ in particle density, and $1/r^2$ in energy flow near the shower cores. The third group comprises the large size shower (larger than 5.5×10^5), which contains many high energy nucleons, thought to be in the state of active nuclear cascade. The integral size spectrum was obtained as $6.1 \times 10^{-9}(N/10^5)^{-1.5}$ cm^{-2} sec^{-1} sterad^{-1} for the showers with a total number of particles 1.5×10^5 – 5.5×10^6; for large size showers the exponent of the spectrum increases with shower size, reaching about −1.9 at $N = 10^6$.

537.591.15

11175. ON THE SPATIAL DISTRIBUTION OF PHOTONS IN THE VICINITY OF THE AXIS OF EXTENSIVE AIR SHOWERS. A.A.Émel'yanov.
Zh. eksper. teor. Fiz., Vol. 34, No. 2, 516-18 (1958). In Russian. English summary: PB 141052T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The Landau equation has been integrated to find this distribution.

In this region ionization loss can be neglected, and the radiation cross-section is taken to be proportional to 1/E, where E is the photon energy. It is found that the ratio of the numbers of photons to electrons (of energy > E) is $N_{ph}/N_{el} \sim \ln(E_c/rE)$ which is about 7-8 at 1 m distance from the axis for E = 10^8 eV and an energy of the primary of 10^{14} eV. E.W.Kellermann

537.591.15

11176. CLOUD CHAMBER INVESTIGATION OF THE [STRUCTURE OF] CORES OF EXTENSIVE AIR SHOWER.
O.I.Dovzhenko, S.I.Nikol'skii and I.V.Rakobol'skaya.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 17-23 (1959). In Russian.

537.591.2

11177. THE ATTENUATION LENGTH OF THE HIGH ENERGY NUCLEONIC COMPONENT OF THE COSMIC RADIATION NEAR SEA LEVEL. K.G.McCracken and D.H.Johns.
Nuovo Cimento, Vol. 13, No. 1, 96-107 (July 1, 1959).

From the analysis of neutron data obtained at two widely separated stations, it is shown that during 1957 the attenuation length of the high energy nucleonic component of the cosmic radiation near sea level was (138.1 ± 0.8) g cm^{-2} at high geomagnetic latitudes. Analysis of data from a number of stations shows that the amplitudes of Forbush type decreases increase by about 12% per 1000 m increase in station altitude. This is taken as evidence that the value of the attenuation length is sensitive to changes in the rigidity spectrum of the primary radiation, becoming greater as the primary cosmic-ray spectrum hardens. It is shown that at sea level near the equator the attenuation length is considerably greater than at high latitudes, having a value of about 159 g cm^{-2}. It is shown that the correction for atmospheric change can be the limiting factor in the study of small time variations in the primary intensity by means of a measurement of the nucleonic component deep in the atmosphere.

537.591.2 : 539.1.07

ENERGY MEASUREMENT OF COSMIC-RAY PARTICLES IN A RANGE ABOVE 10^{11} eV. See Abstr. 9893

537.591.3

11178. THE TRANSITION CURVE OF THE ELECTRON—PHOTON COMPONENT OF EXTENSIVE AIR SHOWERS IN LEAD ABSORBER OF THICKNESSES BETWEEN 0 AND 25 cm.
J.Babecki, L.Jurkiewicz, J.M.Massalski and M.Mięsowicz.
Acta phys. Polon, Vol. 16, No. 1-2, 119-33 (1957).

Measurements of the absorption curves were made with an apparatus containing a normal extensive shower detector composed of three counter trays and a telescope (consisting of three large area counter trays). Eight kinds of coincidences were recorded, with good statistics for two positions of the lead absorber relative to the trays of the telescope. The thickness of the absorber was varied from 0 to 25 cm. Analysis of the results has made possible the evaluation of the ratio (γ/e) of the number of photons to the number of electrons in extensive air showers. The value found for this ratio is 0.70 ± 0.15. This value has been determined with greater accuracy than in measurements of other authors. The results of measurements obtained by different authors in connection with the determination of γ/e are anlysed. It is shown that large numbers of penetrating low energy photons are amongst the particles leaving the lead absorber several centimetres thick, and that they may be recorded by single trays of the telescope, but not by a telescope composed of two or three trays. The recording takes place according to the mechanism suggested by Greisen (1949).

537.591.5 : 523.745

11179. ON THE RECURRENT VARIATIONS OF THE PRIMARY COSMIC RAY INTENSITY DURING A PERIOD OF MAXIMUM SOLAR ACTIVITY. A.Fréon, J.Berry and J.P.Coste.
C.R. Acad. Sci. (Paris), Vol. 248, No. 5, 674-7 (Feb. 2, 1959). In French.

Observations at Pic du Midi (since October 1956) and Kerguélen (since July 1957) during 20 solar rotations established the existence of a variation of the neutron intensity with a period of 27.35 ± 0.1 mean solar days, and a maximum amplitude of 2.2% for October 1957. E.J.Burge

537.591.5 : 523.75

11180. LATITUDE VARIATION OF COSMIC RAY INTENSITY DECREASES AT SEA LEVEL. R.R.Brown.
J. Geomagn. Geoelect., Vol. 10, No. 2, 64-5 (1959).

Intensity decreases of the nucleonic component of cosmic rays during the period surrounding the solar flare event of 23 February 1956 have previously been analysed for mountain altitudes (Abstr. 5862 of 1959). The analysis is extended to the corresponding phenomena observed at sea level. The calculated latitude variation of the intensity decrease is compared with the experimental data from various observatories. E.G.Michaelis

537.591.5

11181. THE ALTITUDE DEPENDENCE OF ATMOSPHERIC COSMIC-RAY NEUTRONS [OVER CANBERRA] AND THE SLOW NEUTRON DENSITY BELOW A WATER SURFACE. R.D.Edge.
Nuclear Phys., Vol.12, No. 2, 182-9 (July (1), 1959).

The dependence was found to be exp (−x/160), where x is the atmospheric depth in g/cm^2. The Szilard—Chalmers reaction in a sodium permanganate solution was employed as the neutron detector and its advantages for the absolute measurement of the cosmic-ray neutron flux are discussed. A similar technique was used to determine the slow neutron flux just below a water surface.

537.591.5

11182. THE POLARIZATION OF SHOWER μ^+-MESONS AT SEA LEVEL. B.A.Dolgoshein and B.I.Luchkov.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 640-1 (1959). In Russian.

The polarization was measured by stopping the mesons in a Wilson cloud chamber containing copper plates. The mesons passed through an estimated 550 g/cm^2 of light material before entering the chamber, implying incident momenta > ~ 1.2 BeV/c. The polarizati was deduced from the up/down asymmetry of the decay positrons, which was found to be 0.604 ± 0.034, indicating 98% polarization. Th expected value for μ-mesons from π-decay is 30%, and a counter experiment by Clark and Hersil (Abstr. 1750 of 1958) gave 19 ± 6%, for mesons having traversed 240 g/cm^2. Depolarization in stopping should be small in both cases (see Abstr. 1749 of 1958). The faster μ-mesons may come from K-decays, which allow almost complete polarization, which would require a ratio of about 1/5 for K-mesons to π-mesons among cosmic-ray particles of about 10 BeV at a heigh of a few kilometers. More information on the dependence of polarization of the μ-mesons on energy should throw light on their mode of production. G.P.McCauley

MAGNETISM

MAGNETIC RESONANCES

538 : 530.14

DETECTION OF ISOLATED MAGNETIC POLES. See Abstr. 10599

538.07 : 621.317.4 : 621.317.78

11183. AUTOMATIC TORQUE BALANCE FOR MAGNETIC ANISOTROPY MEASUREMENTS. R.F.Penoyer.
Rev. sci. Instrum., Vol. 30, No. 8, 711-14 (Aug., 1959).

An automatic torque balance for the determination of magnetic anisotropy in ferromagnetic single crystals is described. The balance consists of a mechanical coupling between a solenoid suspende in a static magnetic field and a single crystal specimen. The torqu produced by the specimen causes a minute motion of the solenoid, which is detected by means of a light beam-mirror-phototube network, and an automatically controlled current is fed back to the solenoid, establishing a torque equal and opposite to that produced. A voltage proportional to the feedback current, and thus the applied torque, is recorded on one axis of an X-Y recorder. The other axi is driven by a voltage governed by the direction of magnetic field in which the crystal is suspended. A method that automatically com pensates for the deviation of magnetization from applied field direc tion in highly anistropic crystals is described, and further advantag of the automatic balance over other systems are discussed.

538.07 : 539.1

TORSION MAGNETOMETER. See Abstr. 10168

538.0

11184. MEASUREMENTS OF THE INTENSITY OF TRANSIENT MAGNETIC FIELDS BY THE FARADAY EFFECT.
J.Mafecki, M.Surma and J.Gibalewicz.
Acta phys. Polon., Vol. 16, No. 1-2, 151-6 (1957).

Transient magnetic fields were produced by discharging a bank of capacitors through a coil. The magneto-optic Faraday

fect was used for measuring the intensity of these fields. The ange in light intensity produced by a rotation of the plane of polar- ation was recorded using a photomultiplier and cathode-ray oscil- graph. Magnetic fields of intensities of about 100 kOe were meas- ed; CS_2, CCl_4 and H_2O were used as optical media.

538.08 : 550.384

185. MEASUREMENT OF RAPID VARIATIONS OF THE EARTH'S AGNETIC FIELD. M.Sauzade and R.Stefant.
R. Acad. Sci. (Paris), Vol. 248, No. 23, 3325-7 (June 8, 1959).

A photoelectric fluxmeter having a sensitivity of 0.05 γ/mm is scribed. A system of five concentric coils with an axial ferrite re 7.5 cm^2 in cross-section, 2 m long is the basic detecting ele- ent in a circuit designed to eliminate unwanted inductive effects. alibration and performance data for the instrument are given.

S.J.St-Lorant

538.08 : 669.2

186. THE MEASUREMENT OF MAGNETIC FIELDS IN LUMINUM REDUCTION FURNACES. J.H.Kent.
Electrochem. Soc., Vol. 105, No. 10, 603-7 (Oct., 1958).

The efficient operation of aluminium reduction furnaces of pacities greater than about 50 kA is affected by electromagnetic rces acting in the molten bath. Measurement of the magnetic fields hich give rise to these forces is made difficult because of the high mperature and corrosive nature of the molten bath. A technique is scribed which overcomes these difficulties. Results are given of easurements made in the baths of furnaces operating at 100 kA with fferent conductor layouts. It is shown how conductor layout design fects the magnetic characteristics of the furnace.

538.1 : 530.162

HEISENBERG FERROMAGNETIC MODEL. RETARDED AND CCELERATED GREEN FUNCTIONS. See Abstr. 10621

538.2

187. THE MAGNETIC SUSCEPTIBILITY OF GERMANIUM OPED WITH IRON. D.Geist and J.Hehnen.
emiconductors and Phosphors (See Abstr. 9597 of 1959) 491-4. German.

Measurements are reported of the diamagnetic susceptibility single crystals of germanium containing a small iron impurity. he susceptibility of a crystal grown from a melt containing 0.01% weight of iron is indistinguishable from that of pure germanium. he susceptibility of a crystal grown from a melt containing 1% by eight of iron, approximately, is interpreted in terms of a precipi- tion of 10^{-6} atomic parts of iron in the ferromagnetic phase.

R.Parker

538.2

188. CALCULATION OF THE DIAMAGNETIC SUSCEPT- BILITIES OF FREE ATOMS. C.Courty.
R. Acad. Sci. (Paris), Vol. 248, No. 15, 2179-81 (April 13, 1959). French.

A method is described for calculating the diamagnetic suscept- ilities of free atoms and ions. The expression derived for sceptibility contains a screening constant deduced from measured lues of the first atomic ionization coefficient. Good agreement is tained between calculated and experimentally determined values r the inert gases and mercury. S.A.Ahern

538.2

189. THE MAGNETIC PROPERTIES OF III-V COMPOUNDS. A.Busch and R.Kern.
elv. phys. Acta, Vol. 32, No. 1, 24-57 (1959). In German.

The magnetic susceptibility of Si, GaP, GaAs, GaSb, InP, $P_{0.2}As_{0.8}$, InAs and a single crystal of InSb was measured between ^{0}K and the melting point. At low temperatures the diamagnetic sceptibility decreases with increasing temperature, but in some ses there is an increase at higher temperatures. The results are terpreted in terms of contributions from the ion cores, the valence d conduction electrons, whose temperature variation is considered detail. E.P.Wohlfarth

538.2 : 541.67

190. MAGNETOCHEMICAL INVESTIGATIONS. XII. THE DIA- AGNETIC SUSCEPTIBILITIES OF SOME PARAFFINS.
.R.Angus, G.I.W.Llewelyn and G.Stott.
rans Faraday Soc., Vol. 55, Pt 6, 887-90 (June, 1959).

For Pt XI, see Abstr. 4160 (1955). The susceptibilities of -hexane, two heptanes and five octanes were measured by the Gouy ethod. Values for characteristic groups have been deduced from ese and other experimental data.

538.2 : 541.67

11191. MAGNETOCHEMICAL INVESTIGATIONS. XIII. AROMATIC HYDROCARBONS.
W.R.Angus, F.B.Hollows, G.Stott, D.D.Khanolkar and G.I.W.Llewelyn.
Trans Faraday Soc., Vol. 55, Pt 6, 890-7 (June, 1959).

The diamagnetic susceptibilities of eighteen aromatic hydrocarbons were measured by the Gouy method. Consideration has been given to basic influences arising from substitution into a benzene nucleus, particularly in relation to the magnitudes of the diamagnetic increments associated with the $>CH_2$ and isopropyl groups. Values are also derived for the phenyl group. Effects of chain-branching and position isomerism on susceptibility values are discussed. It is shown that there is a close correspondence between experimental data and susceptibilities calculated by scalar additivity of group values.

538.2 : 539.2

DIAMAGNETISM OF GRAPHITE. See Abstr. 10253

538.2 : 539.2

SYNTHESIS OF THE SHAPE OF THE FERMI SURFACE IN METALS, FROM OBSERVATIONS OF THE DE HAAS—VAN ALPHEN EFFECT. See Abstr. 10264

538.2

11192. MAGNETIC INVESTIGATIONS ON MIXED CRYSTALS OF Pd AND TRANSITION ELEMENTS. D.Gerstenberg.
Ann. Phys. (Leipzig), Folge 7, Vol. 2, No. 5-6, 236-62 (1958). In German.

Gives the results of susceptibility measurements on mixed crystals of Pd and thirteen transition elements in the temperature region 90-1100°K. The results are discussed in relation to the electron theories of paramagnetism of Pauli and Stoner.

A.E.De Barr

538.2

11193. THE EFFECT OF CONCENTRATION ON THE MAGNETIC SUSCEPTIBILITY OF TRAPPED ELECTRONS AND HOLES IN SEMICONDUCTORS. F.T.Hedgcock.
Canad. J. Phys., Vol. 37, No. 3, 381-3 (March, 1959).

At high impurity concentrations the formation of impurity molecules becomes possible; then, instead of the two electron spins contributing independently to a Langevin type of paramagnetism, they are antiparallel and produce no resultant magnetic moment. Experiments on silicon show, however, that the large decrease in the paramagnetism of trapped carriers at low temperatures does not agree quantitatively with the conclusions of the above model. It seems that one must assume the existence of an impurity band, although difficulties still remain. L.Pincherle

538.2 : 537.311.33

MAGNETIC SUSCEPTIBILITY OF NEUTRON-IRRADIATED Si. See Abstr. 11024

538.2

11194. ANOMALOUS MAGNETIC PROPERTIES OF $Cu(NH_3)_4SO_4.H_2O$ AND $MnSO_4.H_2O$. M.Date.
J. Phys. Soc. Japan, Vol. 12, No. 11, 1314 (Nov., 1957).

Measurements of the paramagnetic susceptibility of these substances between 2 and 20°K, using an a.c. bridge method, showed a marked departure from Curie's law. The measured susceptibilities become almost temperature independent below 10°K.

A.J.Manuel

538.2

11195. MAGNETIC INVESTIGATIONS ON GOLD-RICH MIXED CRYSTALS WITH TITANIUM AND VANADIUM.
E.Vogt and D.Gerstenberg.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 145-53 (1959). In German.

Susceptibility measurements were made between 90° and 900°K on α-phase alloys of gold with titanium and vanadium. Ti in the Au lattice gives rise to paramagnetism which is proportional to concentration and independent of temperature. V dissolves in Au and behaves in a manner which represents a transition between that of Ti and that of Cr and the subsequent transition elements; in the latter alloys the transition metal ions contribute a distinct magnetic moment. The susceptibility of the dissolved V is composed of two terms, one temperature independent, the other obeying a Curie—Weiss law; neither term is proportional to solute concentration. The Curie—Weiss term, when normalized to one g-atom of solute addition, drops rapidly with V concentration, so that the number of moments per g-atom of alloy changes little between 1 and 15 atomic per cent. Interpretations are discussed in terms of band

theory, as well as in terms of Friedel's concept of localized d-states with resonance broadening and exchange splitting.

R.Parker

538.2

11196. THE MAGNETIC PROPERTIES OF THE QUINQUEVALENT COMPLEX FLUORIDES OF MOLYBDENUM, TUNGSTEN, AND RHENIUM. G.B.Hargreaves and R.D.Peacock.
J. Chem. Soc., 1958, 3776-9 (Nov.).

The magnetic moments of the complex fluorides $MMoF_6$, MWF_6, and $MReF_6$ (where M is an alkali metal) were measured over the temperature range 90-300°K.

538.2

11197. THE INDIRECT INTERACTION BETWEEN d-ELECTRONS OF THE TRANSITION METALS. I. FERROMAGNETISM.
A.A.Berdyshev and B.V.Karpenko.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 819-22 (1959). In Russian.

The second approximation of the perturbation theory for the s–d model of the transition metals yields an indirect interaction between d-electrons, in which the conductivity electrons are involved. As a consequence, ferromagnetism may arise when s–d coupling is completely absent or even when the d–d exchange integral is negative.

538.2

11198. ON THE FERROMAGNETIC PHASE IN MANGANESE-ALUMINUM SYSTEM. H.Kōno.
J. Phys. Soc. Japan, Vol. 13, No. 12, 1444-51 (Dec., 1958).

A metallographical investigation was made in the compositional range of 47% to 60% of Mn. A new hexagonal close-packed phase and a metastable tetragonal ferromagnetic phase were found. The formation, structure, stability and thermal and magnetic properties of the latter phase were studied.

538.2

11199. TRANSITIONS FROM FERROMAGNETISM TO ANTIFERROMAGNETISM IN IRON–ALUMINUM ALLOYS. EXPERIMENTAL RESULTS. A.Arrott and H.Sato.
Phys. Rev., Vol. 114, No. 6, 1420-6 (June 15, 1959).

The magnetic behaviour of iron aluminium alloys has been determined for composition from 0 to 40 atomic percent aluminium in external fields to 12 kOe from 4°K to 300°K. The alloys above 33 atomic percent exhibit antiferromagnetism. Those below 28 atomic percent are ferromagnetic. Between 28 and 33 atomic percent, the behaviour is ferromagnetic at room temperature but shows a transition to antiferromagnetism on lowering the temperature. The effect of order on the magnetic properties has also been investigated. Antiferromagnetism is found only in the ordered structures.

538.2

11200. TRANSITIONS FROM FERROMAGNETISM TO ANTIFERROMAGNETISM IN IRON-ALUMINUM ALLOYS. THEORETICAL INTERPRETATION. H.Sato and A. Arrott.
Phys. Rev., Vol. 114, No. 6, 1427-40 (June 15, 1959).

Complicated magnetic properties of α-phase iron-aluminium alloys are successfully described from a theory with a few simple assumptions concerning the magnetic interaction between iron atoms. Two interactions are considered: the direct exchange interaction between nearest neighbouring iron atoms and the indirect super-exchange interaction between iron atoms separated by an aluminium atom. The model also leads to a reinterpretation of the neutron diffraction data. In view of the success of the model, it is to be concluded that the direct exchange interaction between nearest neighbour iron atoms is mainly responsible for the ferromagnetism of α-iron.

538.2

11201. MAGNETICALLY INDUCED ANISOTROPY IN THIN EVAPORATED PERMALLOY FILMS.
W.Andrä, Z.Málek, W.Schüppel and O.Stemme.
Naturwissenschaften, Vol. 46, No. 8, 257-8 (1959). In German.

Reports results of torque measurements for permalloy films (77% Ni, 7-16 × 10^2 A, glass substrate), and deduces uniaxial anisotropy constants between 1.5 and 4.5 × 10^3 erg cm^{-3}, in good agreement with values deduced from the anisotropy fields.

E.P.Wohlfarth

538.2

11202. ZERO CRYSTAL ANISOTROPY ENERGY IN MANGANESE DOPED MAGNETITE. A.v.Kienlin.
Naturwissenschaften, Vol. 46, No. 8, 258 (1959). In German.

Reports measurements of the permeability of sintered specimens of $Mn_xFe_{3-x}O_4$, with $0 \leq x \leq 0.3$, at temperatures between -195° and 50°C. Permeability maxima occur at isotropy points, and these were found to shift to lower temperatures as x increases. The effects of oxidation were also investigated. (See also Abstr. 8906 1955).

E.P.Wohlfar

538.

11203. ON THE ORIGIN OF THE MAGNETIC ANISOTROPY ENERGY OF FERRITES. K.Yosida and M.Tachiki.
Progr. theor. Phys., Vol. 17, No. 3, 331-59 (March, 1957).

Possible sources of the anisotropy energy are investigated fo ferromagnetic ferrites, i.e. Ni-, Co-, Fe- and Mn-ferrites. The cubic anisotropy energy which arises from the anisotropy of the crystalline field acting on magnetic ions described by the function of the spin operator of one ion identically which vanishes for ions with spin less than 2, so that this kind of anisotropy energy vanish for Ni^{2+} and Co^{2+} ions. The anisotropy energy arising from the magnetic dipole–dipole interaction which appears for cubic crysta in its second-order perturbation was calculated for Mn- and Ni-ferrites and that arising from the anisotropic exchange interactior calculated for Ni-ferrite but they were found to be too small to account for the experimental values. Therefore, it is concluded that the major part of the anisotropy energy for Ni-ferrite arises from the anisotropy energy of Fe^{2+} ions, for magnetite from the anisotropy energy of Fe^{2+} and Fe^{3+} ions, and for Mn-ferrite from the anisotropy energy of Fe^{3+} and Mn^{2+} ions. Especially it is shov that the experimental anisotropy energy of magnetite extrapolated to the absolute zero of temperature is in good agreement with the sum of the experimental anisotropy energy of Ni-ferrite and the calculated value of the anisotropy energy of Fe^{2+} ions. For Co-ferrite, its large anisotropy energy seems to come from the pseud quadrupole and anisotropic exchange interactions among Co and Fe ions, but the situation is too complex to carry out the calculation o the anisotropy energy in this case. Finally, the temperature depen dence of the cubic anisotropy energy is calculated for Mn-ferrite, and is shown to decrease as $(T_C - T)^2$ near the Curie temperature Further, the sum of the coefficient, a of the cubic anisotropy Ham tonian for Mn^{2+} and Fe^{3+} ions of the octahedral sites and that for Fe^{3+} ion of the tetrahedral sites have been determined for Mn-ferrite by adjusting the calculated anisotropy-energy versus temperature curve so as to fit the experimental one, and it is found, neglecting the small a-value of Mn^{2+} ions, that the a-value Fe^{3+} ions on octahedral sites has five times as large an absolute value as that of Fe^{3+} ions on tetrahedral sites and that the former has the opposite sign to the latter.

538.2 : 535.3

11204. DE HAAS–VAN ALPHEN TYPE OSCILLATIONS IN THE INFRARED TRANSMISSION OF BISMUTH.
W.S.Boyle and K.F.Rodgers.
Phys. Rev. Letters, Vol. 2, No. 8, 338-9 (April 15, 1959).

A single crystal 40 μ thick, heavily etched to remove surface strain, transmitted about 20% of incident light between 20 and 60 μ wavelength at 2°K; the transmission at the 20 μ absorption edge showed an oscillatory variation with 1/H, with period correspondi to a Fermi energy of 0.017 eV, assuming $m^* = 0.01\ m_0$. Alloying with tin, which lowers the Fermi energy, shifted the edge to a longer wavelength. It is concluded that absorption is due to excitation of electrons into the Fermi surface from levels about 0.05 eV below it.

R.G.Chambe

538

11205. INVESTIGATION OF WEAK FERROMAGNETISM IN SINGLE CRYSTAL $MnCO_3$. A.S.Borovik-Romanov.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 766-81 (1959). In Russian.

The magnetic properties of a very pure natural $MnCO_3$ single crystal have been studied in the temperature range from 1.3 to 30 In accordance with the predictions of the theory (Abstr. 3224 of 19 it has been found that the ferromagnetic moment σ is observed on in the basis plane. Along the triple axis the crystal is paramagnet The temperature dependence of σ, $\chi_\perp$ and $\chi_\parallel$ has been investigate detail throughout the complete region of existence of antiferromag netic ordering. It is shown that, in accordance with the theory of phase transitions of the second kind near the transition point, one

$$\sigma/\chi_\perp \sim \sqrt{T_N - T}.$$

At low temperatures, σ is proportional to T^3 in a wide range fron 1.5 to 23°K (0.7 T_N). The dispersion law and temperature depend ences of the thermodynamical quantities for antiferromagnetics w a magnetic structure of the $MnCO_3$ type have been obtained by the spin wave theory method. In this case the spontaneous magnetizat vector is directed perpendicular to the crystal axis. A result of t

is the absence in the energy spectrum of a gap regulated to the anisotropy field. The theoretical formulae obtained qualitatively agree with the experimental results. Possible causes of the large quantitative discrepancy between the magnitudes of the coefficients which determine the temperature dependence of σ and $\chi_\perp$ are discussed.

538.2

11206. A CONTRIBUTION TO THE STUDY OF THE REVERSAL OF A FERROMAGNETIC CORE PRODUCED BY A CONSTANT VOLTAGE SOURCE. C.Durante.
C.R. Acad. Sci. (Paris), Vol. 248, No. 24, 3412-14 (June 15, 1959). In French.

By using Maxwell's equations it is possible to predict the behaviour of a ferromagnetic core under the action of a constant voltage. From this expressions are derived for the reversal time (temps de basculement) and the equation of the dynamic hysteresis cycle. D.J.Oliver

538.2

11207. AN OBJECTION TO THE SINGLE DOMAIN INCLUSION THEORY OF MAGNETIC HYSTERESIS IN DISPERSION-HARDENED ALLOYS. F.D.Stacey.
Proc. Phys. Soc., Vol. 73, Pt 3, 517-20 (March, 1959).

Shows that the relaxation time for thermal fluctuations of the magnetization of the precipitates in Alnico-type alloys is about 5×10^{-8} sec. E.P.Wohlfarth

538.2

11208. INVESTIGATIONS ON THE TEMPERATURE DEPENDENCE OF THE PROCOPIU EFFECT. F.A.Koch.
Z. Phys., Vol. 155, No. 4, 475-8 (1959). In German.

See Abstr. 983 (1931). The effect, the creation of a longitudinal component of magnetic field during circular magnetization of a ferromagnetic wire, was measured on iron specimens and found to rise to a maximum just below the Curie point, as with the initial permeability. E.P.Wohlfarth

538.2

11209. ON THE MAGNETIC ANNEALING EFFECT IN 2% COBALT–COPPER ALLOY. I. INDUCED FERROMAGNETIC ANISOTROPY. T.Mitui.
J. Phys. Soc. Japan, Vol. 13, No. 6, 549-59 (June, 1958).

The behaviour of ferromagnetic precipitates in Cu—Co alloy containing ~2 wt. % cobalt and heat-treated in a magnetic field was studied with the object of making clear the physical origin of the induced uniaxial anisotropy observed. The magnitude of magnetic anisotropy induced by magnetic annealing was measured as functions of the ageing temperature, ageing time, and intensity of magnetic field. It has been found that almost all of the experimental results can be explained by the fine-particle behaviour of ferromagnetic precipitates. It is shown that the origin of magnetic annealing can be explained neither by the magneto-elastic anisotropy of directional deformation nor by the magnetocrystalline anisotropy, but by the shape anisotropy of precipitated particles, which is distributed preferentially along the direction of magnetic field applied during annealing. It is also shown that magnetic annealing affects remarkably the initial precipitation process rather than the overgrowth stage of precipitation.

538.2

11210. MAGNETIC DOMAINS AND LATTICE DISTORTIONS OF COBALT. K.H.v.Klitzing and A.Pietzcker.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 50-7 (1959). In German.

Domain patterns near twinning planes have a characteristic symmetrical appearance; strong deformations also cause changes of the normal pattern. E.P.Wohlfarth

538.2

11211. THE EXISTENCE OF NEGATIVE BARKHAUSEN JUMPS. J.Kranz and A.Schauer.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 84-8 (1959). In German.

The magneto-optical Kerr-effect was used to study the surface domains in polycrystalline silicon iron. Negative Barkhausen jumps could be observed with certainty by this method. Negative Barkhausen jumps have not always been detected in earlier measurements employing oscillographic techniques and a reason for this discrepancy is suggested in terms of resolution time of jumps between coupled domains. R.Parker

538.2

11212. MAGNETIC FORM FACTOR OF COBALT.
R.Nathans and A.Paoletti.
Phys. Rev. Letters, Vol. 2, No. 6, 254-6 (March 15, 1959).

A single crystal of face-centred cubic cobalt was irradiated with polarized neutrons at room temperature. The reflected intensity ratios with the neutron polarization parallel and antiparallel to the crystal magnetization, respectively, were measured. Since the nuclear structure factor is known the magnetic form factor could be evaluated. Preliminary results are given in tabular and graphical form and these results suggest that the 3d electron shell in cobalt departs from spherical symmetry. R.Parker

538.2

11213. THE INFLUENCE OF MAGNETIC ANNEALING ON THE MAGNETIC BEHAVIOUR AND THE DOMAIN STRUCTURE OF POLYCRYSTALLINE RING SAMPLES. K.Motzke.
Ann. Phys. (Leipzig), Folge 7, Vol. 2, No. 3-4, 163-7 (1958). In German.

The conditions under which magnetic annealing can produce material with a rectangular hysteresis loop have been investigated. It was found that the greatest relative remanence and the highest permeability were obtained when the field was applied when the material had cooled to 550° (170° below the Curie point). Magnetic powder patterns showed that, under these conditions, the material contained large annular domains. A.E.De Barr

538.2

11214. THE TEMPERATURE DEPENDENCE OF FORCED MAGNETOSTRICTION. T.Tsuji.
J. Phys. Soc. Japan, Vol. 13, No. 11, 1310-16 (Nov., 1958).

The forced magnetostriction above technical saturation was measured on some ferromagnetic materials at various temperatures, from the boiling point of oxygen to about 250°C. As expected theoretically, large forced magnetostrictions were observed either as the temperature approached the Curie point, or in samples which have anomalous thermal expansions, such as alloys of the invar system. The results obtained are discussed from the standpoint of thermodynamics. The magnetostriction above the Curie point was also observed.

538.2

11215. THE INFLUENCE OF HYDROSTATIC PRESSURES ON THE CURIE POINT OF A Ni–Zn FERRITE. K.Werner.
Ann. Phys. (Leipzig), Folge 7, Vol. 2, No. 7-8, 403-5 (1959). In German.

A linear variation of $(+0.85 \pm 0.06) \times 10^{-3}$ deg C atm^{-1} in the Curie point of a ring shaped specimen with a normal Curie point of 45°C, was observed in measurements to 5500 atm. A.J.Manuel

538.2

11216. MAGNETOSTRICTION CONSTANTS OF FACE-CENTERED CUBIC NICKEL—COPPER AND NICKEL—COBALT ALLOYS.
M.Yamamoto and T.Nakamichi.
Sci. Rep. Res. Insts Tohoku Univ. A, Vol. 11, No. 3, 168-82 (June, 1959).

The constants λ_{100} and λ_{111} were determined at room temperature, using single-crystal disk specimens and a strain-gauge technique. In Ni—Cu alloys, both constants are negative, irrespective of the composition, and their absolute values decrease monotonously with increasing copper content. In Ni—Co alloys, the concentration dependence is quite different for λ_{100} and λ_{111}; λ_{111} is negative irrespective of the composition, showing a flat minimum centred at about 30% Co, while λ_{100} increases almost linearly with increasing Co content, passing through zero at about 20% Co, and reaching a value of 116×10^{-6} at 55% Co. It has been found that the experimental results on the concentration dependence of its constants of f.c.c. Ni—Co alloys agree quite well with the Vonsovsky—Néel formula for binary cubic solid solutions consisting of two types of magnetic atoms A and B, which is of the form

$$\lambda = C(N_A^2 E_{AA} + 2N_A N_B E_{AB} + N_B^2 E_{BB}),$$

where λ is λ_{100} or λ_{111}; C, a constant; N_A and N_B, the concentrations of the A and B atoms, respectively; and E_{AA}, E_{AB} and E_{BB}, the energies of magnetic interaction between A and A atoms, between A and B atoms, and between B and B atoms, respectively. For binary cubic solid solutions consisting of magnetic and non-magnetic atoms, such as Ni—Cu alloys, it is shown theoretically and experimentally that the following relations hold approximately among the magnetostriction constants, saturation magnetization I_S, and

concentration of non-magnetic atoms N :

$$\lambda_{100} \propto \lambda_{111} \propto I_s^2 \propto (1-N/N_C)^2,$$

where N_C is the concentration where the spontaneous magnetization disappears.

538.2

11217. THE INTERPRETATION OF THE DIFFUSION AFTER-EFFECT OF FERRITES WITH DIVALENT AND TRIVALENT MANGANESE. W.Gieseke.
Z. angew. Phys., Vol. 11, No. 3, 91-5 (March, 1959). In German.

538.2

11218. A RELATION BETWEEN MAGNETIC AFTER-EFFECT AND HYSTERESIS LOSSES OF FERRITES. W.Metzdorf.
Z. angew. Phys., Vol. 11, No. 3, 95-102 (March, 1959). In German.

538.2

11219. THE ELECTRON-DIFFUSION AFTER-EFFECT OF OVER-SINTERED HIGH-PERMEABILITY FERRITES. D.Köhler.
Z. angew, Phys., Vol. 11, No. 3, 103-11 (March, 1959). In German.

The complex permeability of Ni—Zn ferrites, sintered at temperatures above normal, was measured between −183° and 60°C, and the activation energies were deduced from the results.

E.P.Wohlfarth

538.2 : 621.318.132

11220. THE EFFECT OF "COLLECTIVE" RECRYSTALLIZATION ON THE TEXTURE PRODUCED BY PRIMARY RECRYSTALLIZATION. K.V.Grigorov, G.P.Blokhin and É.A.Korzun.
Fiz. Metallov i Metallovedenie, Vol. 4, No. 3, 474-7 (1957). In Russian.

Experimental study of the effect of "collective" recrystallization (a process in which the size of grains increases) on the magnetic properties and the original texture of cold-rolled transformer steel.

538.2

11221. THE MAGNETIC PROPERTIES OF YTTRIUM AND RARE EARTH FERRITES OF FORMULA $5Fe_2O_3$, $3M_2O_3$. R.Pauthenet.
Ann. Phys. (Paris), Ser. 13, Vol. 3, No. 5-6, 424-62 (May-June, 1958). In French.

At a given temperature the magnetizations of the garnets investigated are in general the sum of a ferromagnetic and a paramagnetic term, the Curie point for the ferromagnetic part being approximately 550°K. For compounds with M = Gd, Tb, Dy, Ho, Er and Tm, the variations with temperature of the spontaneous magnetization of the ferromagnetic part, and the reciprocal susceptibility for the paramagnetic part, are in satisfactory agreement with calculations using a molecular field model. For M = Sm and Eu, this simple interpretation is insufficient. From the molecular field coefficients the exchange interaction between neighbouring magnetic ions as a function of separation of the magnetic shells is deduced, giving a curve similar to the Néel curve for metals and alloys.

A.J.Manuel

538.2

11222. EFFECTS OF SOME ADDITIONALS FOR THE MAGNETIC PROPERTIES OF Ba AND Sr OXIDE MAGNETS. H.Kojima.
Sci. Rep. Res. Insts Tohoku Univ. A, Vol. 10, No. 2, 175-82 (April, 1958).

Several oxides used as partial replacements for Fe_2O_3 in $BaO \cdot 5(Fe_2O_3)$ and $SrO \cdot 5(Fe_2O_3)$ produce enhanced values of remanence (up to 2500 G), coercivity (up to 1700 Oe) and $(BH)_{max}$ (up to 1.5×10^6 gauss oersted). Other oxides used to replace part of the BaO or SrO do not improve the properties, and the presence of V_2O_5 is very injurious. As the Curie points are hardly affected, changes in properties are probably due to changes in the density and grain size, not to new ferromagnetic phases.

R.C.Kell

538.2

11223. MAGNETOCALORIC EFFECT OF ANTIFERROMAGNETICS. A.J.P.Meyer.
C.R. Acad. Sci. (Paris), Vol. 248, No. 2, 202-4 (Jan. 12, 1959). In French.

The temperature change is calculated at temperatures above and below the Néel point, T_N, for a polycrystalline antiferromagnetic with two sub-lattices, on the basis of a molecular field treatment. The temperature change reverses its sign at T_N, in agreement with observations on $MnAu_2$ and MnAs.

E.P.Wohlfarth

538.2

11224. ANTIFERROMAGNETISM OF THE TRANSITION METALS [BASED] ON THE COLLECTIVE ELECTRON MODEL.
G.Eremeeva and A.Berdyshev.
Fiz. Metallov i Metallovedenie, Vol. 6, No. 5, 929-30 (1958). In Russian.

Attempts to improve on the theory of Lidiard (Abstr. 7549 of 1954) by the use of shapes other than parabolic (in particular, rectangular) for the d-band do not lead to much better agreement with experiment. Further progress seems to require consideration of, inter alia, s—d overlap.

A.F Brower

538.

11225. ANTIFERROMAGNETISM IN $NiBr_2.6H_2O$.
R.D.Spence, H.Forstat, G.A.Khan and G.Taylor.
J. chem. Phys., Vol. 31, No. 2, 555-6 (Aug., 1959).

The proton resonance spectrum and heat capacity of $NiBr_2.6H_2O$ have been studied as a function of temperature. The observed proton resonance spectrum is indicative of an antiferromagnetic to paramagnetic state change. A curve shows the variation of heat capacity in the temperature range 4°-13°K. A λ-type anomaly was observed with a Néel temperature of 6.50°K. From the heat capacity measurements a value has been calculated for the entropy change associated with the transition. The value obtained, 2.30 cal/mole deg, is in good agreement with the theoretically predictable value of 2.19 cal/mole deg. A large magnetic contribution to the entropy observed above the Néel temperature is attributed to the persistence of short-range order.

S.A.Aher

538.

11226. ON THE MAGNETIC PROPERTIES OF VANADIUM SULFIDE AND SELENIDE. I.Tsubokawa.
J. Phys. Soc. Japan, Vol. 14, No. 2, 196-8 (Feb., 1959).

The magnetic, thermal and crystallographic properties of the sulphide and selenide with nickel arsenide structure were investigated. The antiferromagnetic Néel points for these compounds were found to be about 1040° and 163°K respectively. A correction for the atom core diamagnetism was applied to the observed susceptibilities; the inverse susceptibility decreased linearly with fall of temperature. Based on this result, the Curie constant C_M, the spin quantum number S and the asymptotic Curie temperature θ, were obtained as 1.63, 2.9/2 and −3000° for the sulphide and 2.15, 3/2, 2 and −2570° for the selenide respectively. Anomalous heat absorption at the magnetic transition in both compounds were 615 and 50 cal/m respectively. The results are discussed briefly.

538.2

11227. ON THE MAGNETIC PROPERTIES OF NICKEL SULFIDE.
I.Tsubokawa.
J. Phys. Soc. Japan, Vol. 13, No. 12, 1432-8 (Dec., 1958).

Magnetic measurements were made on specimens of powdered and single crystals of nickel sulphide having the structure of nickel arsenide type. From the results of measurements of the susceptibility, specific heat and other data, it was found that nickel sulphide is antiferromagnetic with the Néel point at 150°K. However, below 120°K, the susceptibility of the powder specimen increased with the fall of temperature and also showed a dependence of magnetic field. Such a rise in susceptibility at lower temperatures is here interpreted as due to the influence of paramagnetic islands. Correction for the atom core diamagnetism was applied to the observed susceptibilities, and from the inverse susceptibility versus temperature relation, the Curie constant per mol, C_M, the spin quantum number S, and the asymptotic Curie temperature, θ, were obtained as 0.89, 1.9/2 and ~ 3000° respectively. From the torque measurement of single crystal of this compound, it was seen that the antiferromagnetic easy direction lies in (0001) plane of the crystal.

538.2

11228. THE ANTIFERROMAGNETIC TRANSFORMATIONS OF THE ALLOY AuMn. A.Giansoldati, J.O.Linde and G.Borelius.
J. Phys. Chem. Solids, Vol. 9, No. 2, 183-4 (Feb., 1959).

538

11229. THE ANTIFERROMAGNETIC ORIENTATION OF MAGNETIC MOMENTS IN THE ALLOY Ni_3Fe. M.V.Dekhtyar.
Zh. eksper teor Fiz., Vol. 34, No. 3, 772-3 (March, 1958). In Russian. English translation in: Soviet Physics—JETP (New York), Vol. 34(7), No. 3, 531-3 (Sept., 1958).

Results are reported for the saturation and remanent intensities of magnetization between room temperature and 600°C for a sample of Ni_3Fe which had previously been quenched from 1200°C. The results suggest that atomic ordering takes place in the lattice near

30°C, that there is a transition from ferromagnetic to ferrimagnetic alignment of spins at 510°C and that the alloy is paramagnetic above 574°C. A magnetic compensation temperature in the ferrimagnetic region has been found at 560°C. The changes in magnetic structures near 510° and 574°C correspond to maxima in the thermal capacity versus temperature curve of Leech and Sykes (Abstr 2692 of 1939). R.Parker

538.27 : 621.317.44

11230. THE DIRECT MEASUREMENT OF THE WIDTH OF THE RESONANCE CURVES OF FERROMAGNETIC MATERIALS. L.Vautier and A.J.Berteaud.
C.R. Acad. Sci. (Paris), Vol. 248, No. 13, 1957-9 (April 1, 1959). In French.

The method described gives the width directly without tracing the whole of the resonance curve. D.J.Oliver

538.27

11231. FERROMAGNETIC RESONANCE IN A CIRCULARLY POLARIZED ELECTROMAGNETIC FIELD OF ARBITRARY AMPLITUDE. G.V.Skrotskii and Yu.I.Alimov.
Zh. eksper. teor. Fiz., Vol. 35, No. 6(12), 1481-4 (1958). In Russian.

An analysis is made of the exact solutions of the magnetization equations of motion. The dependence of the magnetization components on the amplitudes of the constant magnetizing and radio-frequency fields is determined. A comparison is made with experimental results.

538.27

11232. THE THERMODYNAMIC THEORY OF FERROMAGNETIC ABSORPTION. V.L.Beshidze.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 926-8 (March, 1959). In Russian.

A ferromagnetic in an alternating magnetic field absorbs energy because of the finite spin—spin and spin—lattice relaxation times. It is shown that in an isotropic ferromagnetic medium near to the Curie temperature the law of ferromagnetic resonance can be established if the thermodynamic potential is known in a concrete form. A.L.Mackay

536.27

11233. NOTE ON THE FERROMAGNETIC RESONANCE ABSORPTION. T.Oguchi.
Progr. theor. Phys., Vol. 17, No. 5, 659-78 (May, 1957).

The theory of ferromagnetic resonance absorption is discussed in Hamiltonian form. The general formula of magnetic resonance absorption in a ferromagnetic single crystal is obtained when the applied magnetic field has arbitrary intensity and direction. This formula reduces to Kittel's formula in the case of an infinitely strong applied field. When a magnetic field is applied in a direction near the hard axis, an additional resonance is possible in the non-aligned state of the magnetization vector to the direction of the applied field. It is concluded, however, that the mechanism described is not responsible for double peaks in an iron single crystal, reported by Kip and Arnold, and in cobalt ferrite by Tannenwald. The resonance frequencies for antiferromagnetic crystals of ordinary two-sublattice type and that of the triangular lattice are obtained by a similar method.

538.27

11234. MAGNETIC RESONANCE OF FERRITES AT THE COMPENSATION TEMPERATURE. J.Paulevé.
Ann. Telecomm., Vol. 13, No. 11-12, 311-24 (Nov - Dec., 1958). In French.

The theory of ferrimagnetic resonance is developed in detail, and methods for the experimental observation of the phenomenon are described. E.P.Wohlfarth

538.27

11235. MAGNETIC RESONANCE OF FERRITES AT THE COMPENSATION TEMPERATURE (CONCLUSION). J.Paulevé.
Ann. Telecomm., Vol. 14, No. 1-2, 2-20 (Jan.-Feb., 1959). In French.

For previous part, see preceding abstract. Reports results of measurements on $Li_{0.5}Fe_{2.5-x}Cr_xO_4$ ($x = 1.25, 1.5$) and on erbium and gadolinium garnets. E.P.Wohlfarth

538.27

11236. THE ANOMALIES IN THE PERMEABILITY OF FERRITES AT HIGH FREQUENCIES. P.M.Prache.
Bull. Soc. Franc. Elect., Vol. 9, 329-40 (June, 1959). In French.

The classical theory of the gyromagnetic effect predicts a single peak in the real and imaginary susceptibilities as the applied field or the frequency is varied. The concept of a demagnetizing field should, however, be used only when the wavelength is large compared with the distances between magnetic elements. Regarding the electrons as elementary magnets subject to mutual interaction leads to the theory of spin waves (Abstr. 4119 of 1958) and account for susceptibility peaks at frequencies of tens of kMc/s. Domains also form elementary magnets and have dimensions considerably larger than the interatomic distances. They could therefore account for peaks at much lower frequencies. By plotting the results in the complex plane of the normalized susceptibility, the observed anomalies are shown to be consistent with those obtained from a crude model of four magnets subject to mutual interaction. R.C.Kell

538.27

11237. ON THE THEORY OF RESONANCE LINE WIDTH IN FERRITES. S.Krupička.
Czech. J. Phys., Vol. 8, No. 5, 613-14 (1958).

A discussion of the results of previous work on zinc-manganese ferrites. The resonance line-width ΔH is shown to be linearly dependent on the square root of the saturation magnetization of the material. A.J.Manuel

538.27

11238. SOME PECULIARITIES OF MULTIPLET FERROMAGNETIC RESONANCE IN FERRITES. V.N.Lazukin.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 682-9 (1959). In Russian.

Some preliminary results for inhomogeneously magnetized single and polycrystalline ferrite samples are presented. The inhomogeneous magnetizations required for observation of the effect were mainly produced by the inhomogeneity of the demagnetizing fields of the investigated samples. Some peculiarities of the absorption spectra measured under various conditions are indicated.

538.27

11239. PARAMAGNETIC RELAXATION OF COPPER TUTTON SALT. Y.Nagaoka.
J. Phys. Soc. Japan, Vol. 13, No. 11, 1328-32 (Nov., 1958).

The spin—lattice relaxation time is calculated on the Van Vleck theory. At liquid-helium temperatures, calculated relaxation time shows a remarkable anisotropy, which arises from the nature of orbital states of Cu^{2+} in the crystalline field. Its order of magnitude is too large compared with the value 2×10^{-4} sec measured by Townes et al. At liquid-air temperatures, however, it is in fairly good agreement with experimental data if a reasonable value is assumed for the separation of the first-excited orbital state from the ground state.

538.27

11240. SPIN QUENCHING AND MAGNETIC RESONANCE. T.Moriya and Y.Obata.
J. Phys. Soc. Japan, Vol. 13, No. 11, 1333-44 (Nov., 1958).

The effect of the magnetic ions of those paramagnetic salts whose spin degeneracy is completely lifted by the combined action of the spin—orbit coupling and the crystalline electric field, on the magnetic resonance of nuclear spins and electronic spins of other kind of ions such as Cu^{2+}, Co^{2+}, Mn^{2+} substituted for the host ions is studied theoretically. General formulae for the resonance field shift, line width and the thermal relaxation time in nuclear (or electron) spin resonance in magnetic substances are given. T_1 and T_2 are here related to the difference between isothermal and isolated susceptibilities. Temperature dependence of T_1 and T_2 as well as magnetic field dependence of them are studied. At low temperatures they become longer rapidly (exponentially) as temperature is lowered while at high temperatures they are independent of temperature. Field dependence of the line width is of the type of $H_0^2 + H_i^2$ when the line is narrowed by spin—spin interaction among the host ion spins, or $\sqrt{H_0^2 + H_i^2}$ when the line is not narrowed, where H_i denotes the local magnetic field. Field dependence of $1/T_1$ is always the same as $H_0^2 + H_i^2$. The theoretical results are compared with some available experimental data on electron spin resonance. The agreement between theory and experiment seems to be not unreasonable as far as order of magnitude and qualitative characters of the line width are concerned, though experimental data are rather scanty.

538.27 : 539.18 : 621.316.729

11241. ATOMIC-BEAM MAGNET-STABILIZATION SYSTEM. G.O.Brink and N.Braslau.
Rev. sci. Instrum., Vol. 30, No. 8, 670-4 (Aug., 1959).

A system is described which allows the magnetic field of the "C" magnet of an atomic-beam magnetic-resonance apparatus to be

locked to a resonance in the beam. The construction of the system is discussed and representative performance data are presented.

538.27 : 539.2

PARAMAGNETIC RESONANCE OF COLOUR CENTRES IN GERMANIUM-DOPED QUARTZ. See Abstr. 10238

538.27 : 537.311.33

11242. PARAMAGNETIC RESONANCE IN ELECTRON IRRADIATED SILICON. G.Bemski.
J. appl. Phys., Vol. 30, No. 8, 1195-8 (Aug., 1959).

Electron spin resonance was observed in n-type silicon irradiated with 0.5 MeV electrons. The particular resonance lines discussed here appear only in pulled crystals which contain about 10^{18} oxygen atoms per cm^3. The lines do not appear in floating zone crystals ($< 10^{17}$ oxygen per cm^3). The pattern is anisotropic with respect to the field orientation and can be fitted with a g-tensor with components $g_{[100]} = 2.0029$, $g_{[110]} = 2.0019$, $g_{[111]} = 2.0096$. Hyperfine structure due to interactions with Si^{29} nuclei is also observed. The hyperfine structure tensor exhibits a [111] symmetry indicating that the electron is not centred on the silicon nucleus with which it is interacting. A model is suggested, consistent with the observed symmetries, according to which vacancies produced during irradiation diffuse to the distorted regions around oxygen atoms.

538.27 : 537.311.33

11243. SPIN RESONANCE IN ELECTRON IRRADIATED SILICON. G.D.Watkins, J.W.Corbett and R.M.Walker.
J. appl. Phys., Vol. 30, No. 8, 1198-1203 (Aug., 1959).

The spin resonance behaviour in room temperature irradiated n-type silicon is observed to be significantly different for silicon grown in quartz crucibles from that grown by the floating zone method. The dominant spectrum in each is discussed. The defects giving rise to the spectra are interpreted as containing impurity atoms and as having formed when the impurities trap mobile interstitials and/or vacancies. In quartz crucible grown silicon, the impurity may be oxygen. In the floating zone material, the impurity appears to be the phosphorus used in doping. A 20°K irradiation and anneal is described which suggests the temperatures at which this defect motion is occurring. Features of the spin resonance spectra suggest that the vacancy may be the mobile effect.

538.27

11244. CRYSTAL CONSTITUENT EFFECTS. II. PARAMAGNETIC RESONANCE OF Ni^{+3} IN DOUBLE NITRATES.
R.H.Hoskins, R.C.Pastor and K.R.Trigger.
J. chem. Phys., Vol. 30, No. 6, 1630-1 (June, 1959).

For Pt I see Abstr. 7179 (1959). Paramagnetic resonance of Ni^{++} was observed in four isomorphous double nitrates to investigate the effects of crystal constituent changes in a mixed salt system (Ni^{++} concentration ~ 1%). The results are fitted to the spin Hamiltonian

$$\mathcal{H} = g\beta\vec{H}.\vec{S} + D[S_Z^2 - \tfrac{1}{3}S(S+1)]$$

The D values vary with the size of the host cations used and the variation seems consistent with the pressure dependences previously measured (see Abstr. 409 of 1958) if the disparities in the metallic ionic radii lead to the distortion of the magnetic complex. The temperature dependence of D is also discussed. J.M.Baker

538.27

11245. CRYSTAL CONSTITUENT EFFECTS. III. PARTITION OF Ni^{++}. R.C Pastor.
J. chem. Phys., Vol. 31, No. 2, 514-18 (Aug., 1959).

A phenomenological treatment of partition of a solute ion between the saturated solution and the equilibrated crystal is given. The description is applicable to the experimental results obtained with Ni^{++} as the solute ion in $(Zn,Ni)SiF_6$ and in $(Mg,Ni)SiF_6$ solutions. Crystal coring in mixed crystals is discussed from the standpoint of partition coefficients. The partition coefficient for Ni^{++} was also measured by using other host salts isotypic with the fluosilicate.

538.27

11246. PARAMAGNETIC RESONANCE SPECTRA OF ACTIVE SPECIES. BLUE MATERIAL FROM HYDROZOIC ACID.
W.B.Gager and F.O.Rice.
J. chem. Phys., Vol. 31, No. 2, 564 (Aug., 1959).

A study was made of the decomposition products of hydrozoic acid. It has been shown previously [Rice and Freamo, J. Amer. Chem. Soc., Vol. 73, 5529 (1951)] that when the acid flowing at low pressure in a system is decomposed either thermally or electrically, and the products suddenly cooled to 77°K, a deep blue solid, stable indefinitely at this temperature, condenses. E.P.R. spectra of three samples of this material, prepared thermally, electrically and photochemically, have been taken. All these gave a single line at $g = 2.003 \pm 0.002$. The derivatives of these lines are asymmetric and the lines disappear at 148°K. S.A.Ahern

538.27

11247. STRESS AND TEMPERATURE DEPENDENCE OF THE PARAMAGNETIC RESONANCE SPECTRUM OF NICKEL FLUOSILICATE. W.M.Walsh, Jr.
Phys. Rev., Vol. 114, No. 6, 1473-85 (June 15, 1959).

The crystalline field splitting of the ground-state spin-triplet of divalent nickel in the fluosilicate, $NiSiF_6 \cdot 6H_2O$, has been measured at room temperature as a function of hydrostatic pressure to 10 000 kg/cm^2 and uniaxial stress to 150 kg/cm^2. The anisotropic compressibility and thermal expansion of this trigonal crystal have also been determined. Combining these data with the known variation of the splitting with temperature, its dependence on isothermal unit cell geometry and on temperature at constant unit cell dimensions is calculated. The splitting is found to be independent of volume within experimental error but proves to be quite sensitive to unit cell shape. The deduced explicit temperature dependence is three times larger than that measured at atmospheric pressure. The magnitude and geometrical variation of the crystalline field splitting may be qualitatively understood using a static, ionic model of the $(Ni \cdot 6H_2O)^{2+}$ octahedral complex. A rather general analysis of the explicit temperature dependence indicates, however, that low-frequency lattice vibrations play a dominant role in determining the observed value of the splitting. The resonance line widths are observed to increase monotonically and quite nonlinearly with increasing pressure. This broadening is discussed in terms of isotropic and anisotropic exchange interactions. In agreement with earlier conclusions of Ollom and Van Vleck it is inferred that the two mechanisms are of comparable importance in this paramagnetic salt.

538.27

11248. PARAMAGNETIC SPECTRA OF SUBSTITUTED SAPPHIRE. I. RUBY. E.O.Schulz-du Bois.
Bell Syst. tech. J., Vol. 38, No. 1, 271-90 (Jan., 1959).

The paramagnetic resonance properties of Cr^{+++} ions in Al_2O_3 (ruby) were investigated theoretically and experimentally in order to obtain information necessary for the application of this material in a three-level solid-state maser. Numerically computed energy levels, together with their associated eigenvectors, are presented as a function of applied magnetic field for various orientations of the magnetic field with respect to the crystalline symmetry axis. A more detailed discussion is devoted to energy levels, eigenvectors and transition probabilities at angles 0°, 54.74° and 90°, where certain simple relations and symmetries hold. Paramagnetic spectra for signal frequencies between 5 and 24 kMc/s are shown; agreement between computed and measured resonance fields is satisfactory.

538.27

11249. SPIN—PHONON INTERACTION IN RUBY.
N.S.Shiren and E.B.Tucker.
Phys. Rev. Letters, Vol. 2, No. 5, 206-7 (March 1, 1959).

An experimental test of spatial transfer of spin temperature in synthetic ruby at 1.7°K and 20°K and 9.3 kMc/s, using two cavities and one crystal. The negative result favours relaxation by a spin—lattice rather than a lattice—bath (hot phonon) mechanism. J.G.Powles

538.27

11250. ELECTRON PARAMAGNETIC RESONANCE OF MANGANESE IV IN $SrTiO_3$. K.A.Müller.
Phys. Rev. Letters, Vol. 2, No. 8, 341-3 (April 15, 1959).

The spectra observed in the cubic and tetragonal phases consis of six hyperfine groups with $g = 1.994 \pm 0.001$, hyperfine constant 75 ± 1 gauss, and a small fine-structure splitting, and are attributed to Mn^{IV} ions at Ti^{4+} sites. The degree of covalent bonding is discussed. E.F.W.Seymour

538.2

11251. ELECTRON FREE PRECESSION IN PARAMAGNETIC FREE RADICALS. D.E.Kaplan and M.E.Browne.
Phys. Rev. Letters, Vol. 2, No. 11, 454-5 (June 1, 1959).

Free induction electron resonance signals, following a short intense pulse have been observed at 9.3 kMc/s in D.P.P.H. and other solid free radicals. The T_2 values, of order 100 mμsec, agree with steady-state line-width values. J.G.Powles

538.27

252. HYPERFINE STRUCTURE AND THE RELAXATION ECHANISM OF ELECTRON RESONANCE IN SOLUTION.
.H.Hausser.
. Naturforsch., Vol. 14a, No. 4, 425-36 (April, 1959). In German.

Gives the hyperfine spectra of a number of organic free radicals, diradical and a metal complex in various organic solvents in the mperature range from +20°C to −140°C. The temperature has a ajor effect on the resolution obtained and a qualitative explanation given in terms of relaxation broadening. The low temperature paratus is described. J.G.Powles

538.27

253. CHARACTERISTICS OF THE BEAM TYPE MASER. II.
.Shimoda.
Phys. Soc. Japan, Vol. 13, No. 8, 939-47 (Aug., 1958).

For Pt I, see Abstr. 4172 (1958). Experimental investigation of e characteristics of the ammonia maser is given and compared with eory. Observed saturation characteristics agree fairly well with e theory described in Pt I. The change of oscillation frequency ows the expected increase with focuser voltage, which arises from resolved hyperfine structure of the 3,3 line. Small discrepancies e explained by the velocity distribution and different saturation of ch hyperfine component. Frequency pulling due to cavity detuning as measured in detail and compared with theory. Thus the velocity read of the effective molecules in the cavity can be estimated as ughly ±30%. A tentative estimate of the centre frequency on UT2 compared with other measurements.

538.27

1254. THREE LEVEL MASERS AS HEAT ENGINES.
.E.D.Scovil and E.O.Schulz-DuBois.
hys. Rev. Letters, Vol. 2, No. 6, 262-3 (March 15, 1959).

The three level maser is compared with the Carnot engine. he main conceptual difference is that whereas the latter has a ntinuous spectrum of energies, the limited number of states in e maser is a simplification. In limiting cases the efficiencies are ual. The possibility of thermal excitation of masers is attractive higher microwave frequencies. D.Walsh

538.27

1255. PROPOSAL FOR A "STAIRCASE" MASER.
.E.Siegman and R.J.Morris.
hys. Rev. Letters, Vol. 2, No. 7, 302-3 (April 1, 1959).

In a three level system with the 1 → 2 and 2 → 3 transitions ughly equal it should be possible to invert these successively with e same pump frequency. Then the system would amplify at twice e pump frequency. Extension to more than two steps is conceivable. D.Walsh

538.27

1256. MEASUREMENT OF MAGNETIC RESONANCE ELAXATION IN THE PRESENCE OF A DRIVING FIELD.
Solomon.
.R. Acad. Sci. (Paris), Vol. 248, No. 1, 92-4 (Jan. 5, 1959). In rench.

Describes a method of measuring the spin—spin relaxation me (T_2) in nuclear magnetic resonances in the presence of a esonant driving radio-frequency field (H_1). Transverse magnetiation is produced in the direction of the steady rotating field H_1 by 90° pulse whose r.f. is 90° out of phase with H_1 and it is allowed to ecay. On cutting H_1 a Bloch decay is produced from which $T_2(H_1)$ an be measured. The method is claimed to avoid the usual difficulties of measuring relaxation times in the presence of a driving eld (Abstr. 7257 of 1955). Examples of its use in measuring quids are given but its main interest will be for measuring solids. J.G.Powles

538.27

1257. HIGH RESOLUTION AND THE MEASUREMENT OF WEAK IELDS BY NUCLEAR MAGNETIC RESONANCE.
.Hochstrasser, G.Béné and R.Extermann.
.R. Acad. Sci. (Paris), Vol. 248, No. 2, 218-20 (Jan. 12, 1959). In rench.

Describes a proton magnetic resonance spectrometer of the ridge type operating in the earth's field in a special laboratory aving a resolution of better than 10^{-4} gauss. The measured line idth of pure benzene is 10^{-5} gauss (the true value is 4×10^{-6} gauss). his therefore allows the measurement of true line-width greater an about 10^{-5} gauss directly. In addition the variation of the arth's field with time can be measured to about 10^{-6} gauss. J.G.Powles

538.27

11258. NUCLEAR-RESONANCE GENERATOR, WORKING IN THE MAGNETIC FIELD OF THE EARTH. F.I.Skripov.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 6, 998-1000 (1958). In Russian.

Describes the construction and performance of an apparatus which realizes a continuous signal from the free precession of nuclei in the terrestrial magnetic field. (Abstr. 3326 of 1958). P.K.Kabir

538.27

11259. ON PRESSURE DEPENDENCE OF PROTON MAGNETIC RESONANCE SHIFT. B.N.Bhar.
Helv. phys. Acta, Vol. 31, No. 6, 636 (1958).

It is pointed out that the proton chemical shift in the gaseous phase may be pressure dependent. J.G.Powles

538.27

11260. NUCLEAR MAGNETIC RESONANCE IN LEAD-CONTAINING COMPOUNDS. J.M.Rocard, M.Bloom and L.B.Robinson.
Canad. J. Phys., Vol. 37, No. 4, 522-5 (April, 1959).

Reports resonance frequency relative to deuterium in D_2O (≅ 1.36) and line width for Pb^{207} resonance in a number of lead compounds in powder form, and preliminary measurements on single crystals of lead carbonate and lead acetate. The line widths of several gauss, are larger than expected from dipole—dipole interaction and are thought to be due in large measure to anisotropy of the diamagnetic shift especially in the single crystals. If so, this is the only case of this apart from C^{13} (Abstr. 2881 of 1959). J.G.Powles

538.27

11261. NUCLEAR MAGNETIC RESONANCE EXPERIMENT ON METAL CADMIUM. II. Y.Masuda.
J. Phys. Soc. Japan, Vol. 13, No. 6, 597-604 (June, 1958).

For previous Pt, see Abstr. 4281 (1958). The spin—lattice relaxation time, T_1, and the spin—spin relaxation time, T_2, of the resonance line in metal cadmium were measured. The contribution of p-character in the conduction electron to the relaxation was estimated. The line-width was measured between room temperature and 250°C. It was shown that the exchange broadening between unlike spins underwent a motional narrowing. The inverse line-width or spin—spin relaxation time, T_2, was interpreted in terms of the lattice diffusion theory. These analyses yielded for the coefficient of self-diffusion D the value $0.05 \exp(-17.6 \text{ kcal/mol-RT}) \text{cm}^2/\text{sec}$.

538.27 : 539.2

11262. ANISOTROPY OF NUCLEAR MAGNETIC RESONANCE DUE TO CRYSTAL DISLOCATIONS. E.Otsuka.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1155-67 (Oct., 1958).

Using plastically deformed crystals of KI, the nuclear magnetic resonance of I^{127} was observed. The broadened signals of I^{127} show distinct anisotropy as regards the direction of the external magnetic field. This is interpreted to arise from the definite orientation of a crystal dislocation. The experimental results are analysed in terms of the gradient-elastic tensor which was introduced by Shulman—Wyluda—Anderson. It is concluded that densities of edge and screw dislocations are fairly well balanced and increase for a certain range almost linearly with degree of cold-working, in agreement with the previously reported result for KBr. Assuming the total dislocation density to be 10^9 cm^{-2} for 10% deformation, $|C_{44}| \cong 8 \times 10^4$ statvolts/dyne and $|C_{11}|$ is a third of this. Comparison with the result for KBr shows that the amplification factor of eQq is greater than 50 for I^{127} in KI.

538.27

11263. NUCLEAR MAGNETIC RESONANCE OF TRANSITION ELEMENTS IN PARAMAGNETIC SALTS. T.Morya.
J. Phys. Soc. Japan, Vol. 13, No. 11, 1344-52 (Nov., 1958).

This is studied theoretically for two cases. One is the case where the magnetic ions have no Kramers degeneracy and their spin degenerary is completely lifted by the combined action of the spin—orbit coupling and the crystalline electric field. The other is the case of ideal paramagnetic substances under a strong magnetic field and at low temperatures. The resonance field (or frequency) shift, the relaxation times T_1 and T_2 due to hyperfine interaction and the indirect nuclear spin coupling via electron spins are calculated. The results show that the nuclear resonance of transition elements in paramagnetic salts is expected to be observable under favourable conditions.

538.27

11264. NUCLEAR MAGNETIC RESONANCE ACOUSTIC ABSORPTION IN KI AND KBr. D.I.Bolef and M.Menes.
Phys. Rev., Vol. 114, No. 6, 1441-51 (June 15, 1959).

A technique for measuring the coupling between nuclear spins and the crystal lattice is described. The technique is one in which the absorption of energy by the nuclear spins from an acoustic wave is observed as an additional attenuation of the wave in the sample. This attenuation results in a change in the electric impedance of the piezoelectric transducer which drives the sample. The transducer impedance is made to control a Pound–Watkins type of spectrometer through an inverting and matching network. Nuclear magnetic resonance acoustic absorption measurements were made on single crystal samples of KI and KBr using compressional waves in the [100] direction. These measurements yield a value of the electric quadrupole coupling e^2q_1Q, where q_1 is the first derivative with respect to strain of the electric field gradient at the nuclear position. For I^{127} in KI, $e^2q_1Q/h = 300$ Mc/s. For Br^{81} in KBr, $e^2q_1Q/h = 82$ Mc/s. Interpreting these results on the basis of a point charge model values of the amplification factor γ are obtained. For KI^{127}, $\gamma = 38$. For KBr^{81}, $\gamma = 26$.

538.27

11265. FREE INDUCTION DECAYS OF ROTATING SOLIDS. I.J.Lowe.
Phys. Rev. Letters, Vol. 2, No. 7, 285-7 (April 1, 1959).

A theoretical argument predicts that the effect of spinning a nuclear resonance sample at a frequency f_S should be to produce periodic signals at a frequency f_S in addition to the normal free induction decay. The corresponding line shape should be narrower in the central region but should possess sidebands at frequencies $n.2f_S$. Experiments on the F^{19} resonance in CaF_2 and Teflon confirm this. D.J.Oliver

538.27

11266. OBSERVATION OF THE Co^{59} NUCLEAR MAGNETIC RESONANCE IN PARAMAGNETIC SALTS. R.G.Shulman.
Phys. Rev. Letters, Vol. 2, No. 11, 459-60 (June 1, 1959).

The Co^{59} nuclear magnetic resonance has been observed in $KCoF_3$ and in CoO which are paramagnetic salts. The line width in $KCoF_3$ is 105 gauss at 298°K and the effective g value is 1.2232 kc/s/gauss which compares with values between 1.01 and 1.25 in diamagnetic salts. Both vary with temperature. Reasons leading to the choice of these materials and a preliminary interpretation of the results is given. J.G.Powles

538.27

11267. ON THE THEORY OF NUCLEAR PARAMAGNETIC RESONANCE IN LIQUIDS. G.V.Skrotskii and A.A.Kokin.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 481-7 (1959). In Russian.

The quantum theory of magnetic resonance absorption is applied. Thermal motion of the molecules, which leads to narrowing of the absorption line, is taken into account on basis of diffusion theory. The transverse and longitudinal relaxation times and the correction to the gyromagnetic ratio are computed.

538.27

11268. EFFECTS OF IMPURITIES IN SODIUM CHLORATE ON NUCLEAR QUADRUPOLE RESONANCE. A.Douillet and B.Dreyfus.
C.R. Acad. Sci. (Paris), Vol. 248, No. 14, 2087-9 (April 6, 1959).
In French.

A study of the line width and intensity of the Cl^{35} pure quadrupole resonance in $NaClO_3$ with added $NaBrO_3$ as impurity up to 0.7 molar per cent. The line gets broader and weaker and an explanation is given. J.G.Powles

538.27

11269. NUCLEAR QUADRUPOLE RESONANCE OF DICHLOROCYCLOHEXANONE. K.Kozima and S.Saito.
J. chem. Phys., Vol. 31, No. 2, 560-1 (Aug., 1959).

Nuclear quadrupole resonance measurements were made on the first two of the possible three compounds of dichlorocyclohexanone (referred to as I, m.p. 71.1-71.2°C; II, m.p. 24.5-24.8°C; and III, b.p. 85.2°C/3.5 mm and m.p. 18.6°C) in an attempt to decide between alternative sites for certain chlorine atoms. The results indicate that compounds I and II are respectively 2e,6e-dichlorocyclohexanone, and 2e,2a-dichlorocyclohexanone, the symbols e and a having the meanings given by Barton et al. [Nature, Vol. 172, 1096 (Dec. 12, 1953)]. The description of results is followed by a short discussion. S.A.Ahern

538.2

11270. ZEROSPLITTING CONE OF NUCLEAR QUADRUPOLE RESONANCE SPECTRUM. FOR SPIN 5/2.
K.Shimomura and N.Inoue.
J. Phys. Soc. Japan, Vol. 14, No. 1, 86-90 (Jan., 1959).

Zero-splitting loci of the nuclear quadrupole resonance spectr of the iodine nucleus of iodic acid were studied. The directions of axes of zero-splitting cones of $\nu_1(\pm 1/2 \leftrightarrow \pm 3/2)$ and $\nu_2(\pm 3/2 \leftrightarrow \pm 5/2$ lines have been found to be appreciably different from each other. The situation was interpreted by use of Cohen's theory of Zeeman splitting and the zero-splitting condition was presented. The directions of axes of zero-splitting cones of ν_1 and ν_2 lines were shown to be coincident with the y- and z-axes of the principal axes of the field gradient tensor at the resonant nucleus, respectively. Cohen's theory was verified by the comparison of the experimental values of zero-splitting angles with the theoretical ones.

ELECTROMAGNETISM

MAGNETOHYDRODYNAMICS

538.3 : 532.5 : 523.

11271. THE PROPAGATION OF MAGNETOHYDRODYNAMIC WAVES IN COSMIC CONDITIONS. B.N.Gersham.
Astron. Zh., Vol. 36, No. 1, 190-2 (1959). In Russian.

The results, which follow from the kinetic theory of hydromag netic waves in a plasma, have been applied to some cases met wit in astrophysics (e.g. waves inside the sun, in the solar atmosphere and in the interstellar medium). It was found that the specific dan ping of waves in the plasma not connected with impacts exceeds t damping due to collisions.

538.3 : 532.

11272. RAREFIED ELECTRICALLY CHARGED GAS IN A MAGNETIC FIELD. II. INTENSITY FIELD OF PARTICLE FLUX. M.Łunc and J.Luboński.
Bull. Acad. Polon. Sci. Ser. Sci. tech., Vol. 6, No. 5, 255-6 (1958).
In French.

In Pt I [Bull. Acad. Polon. Sci. Ser. Sci. tech., Vol. 6, No. 5, 229 (1958)], the authors calculated the density distribution in a collision-free gas of charged particles emitted isotropically with Maxwell distribution from, and absorbed at the same rate by, a plane wall situated parallel to a uniform magnetic field. Here the current distribution is calculated and presented graphically. O.Penros

538.3 : 532

11273. RAREFIED ELECTRICALLY CHARGED GAS IN A MAGNETIC FIELD. III. GAS CONTAINED BETWEEN TWO IDENTICAL PARALLEL PLANE WALLS. M.Łunc and J.Luboński
Bull. Acad. Polon. Sci. Ser. Sci. tech., Vol. 6, No. 5, 257-60 (1958)
In French.

The situation considered in two previous papers (see precedin abstract) is generalized to the case where two walls are present. Both the density and the current distributions are calculated, and presented graphically for selected values of the wall spacing. O.Penros

538

11274. ON THE SINGULAR ELECTROMAGNETIC FIELD IN THI BORN–INFELD THEORY. S.Kichenassamy.
C.R. Acad. Sci. (Paris), Vol. 248, No. 26, 3690-2 (June 29, 1959).
In French.

It is shown that the theory of Born and Infeld leads to the sam results as that of Maxwell in the singular case. T.R.Cars

538.3 : 532

11275. THE APPEARANCE OF MAGNETIC "SQUEEZING-OUT" OF FLOW IN A CONDUCTING MEDIUM. V.N.Zhigulev.
Dokl. Akad. Nauk SSSR, Vol. 126, No. 3, 521-3 (May 21, 1959).
In Russian.

Steady flow of an electrically conducting fluid past a magnetiz body is considered. At high enough magnetization and Reynolds number, it is shown that in principle a flow is possible where a surface S surrounds the body and there is no fluid inside S and no magnetic field outside S. The surface conditions to be satisfied or S are discussed. A special two-dimensional case is considered in detail, where the body is a wire carrying current at right angles t

the gas flow; the equation of the surface S for very high Mach numbers is derived by means of a conformal mapping.

O.Penrose

538.3 : 532.5

11276. ALFVÉN WAVES IN A GAS DISCHARGE. D.F.Jephcott.
Nature (London), Vol. 183, 1652-4 (June 13, 1959).

A report of experiments using toroidal gas discharges of 10 kA and 200 μsec duration in monatomic gases at initial pressures of about 100μ. Wave velocities were measured with axial fields in the range of 3 to 14 kG. It is suggested that wave velocity measurements might be used to determine the ion density of a plasma in a magnetic field, and that the degree of ionization might be determined from measurements of damping. R.A.Newing

538.3 : 532.5

11277. THEORETICAL CONSIDERATIONS ON THE BEHAVIOUR OF A PLASMA IN ELECTRICAL AND MAGNETIC FIELDS. H.C.Brinkman.
Ned. Tijdschr. Natuurkde, Vol. 25, No. 5, 133-41 (May, 1959). In Dutch.

This brief, lucid survey discusses: (1) the role of collisions and its dependence on temperature; (2) the information on viscosity and electrical conductivity obtainable from dimensional arguments; (3) the magnetic mirror effect — a simple, approximate analytic treatment supplemented by results of numerical integration; (4) the assumptions of general plasma theory and magnetohydrodynamics, and an example (magnetic mirror) clarifying the question of their range of applicability. B.Meltzer

538.3 : 532.5

11278. HYDROMAGNETIC EQUILIBRIUM. II. STABILITY IN THE VARIATIONAL FORMULATION. L.Woltjer.
Proc. Nat. Acad. Sci. U.S.A., Vol. 45, No. 6, 769-71 (June, 1959).

For previous work, see Abstr. 1599 (1959). It is noted that the variational method would give all possible equilibrium solutions if a complete set of integrals were used as constraints. The method gives both stable and unstable configurations, and a second variation of energy would be necessary in general to find stable conditions, but the state of lowest energy can be found by simple methods in some cases. R.A.Newing

538.3 : 532.5

11279. VISCOUS FLOW OF A PERFECTLY CONDUCTING FLUID WITH A FROZEN MAGNETIC FIELD. H.Hasimoto.
Phys. of Fluids, Vol. 2, No. 3, 337-8 (May-June, 1959).

Steady incompressible flows satisfying the condition $v = \beta H\sqrt{(\mu/\rho)}$ are considered. The equation of motion reduces to the steady-state Navier–Stokes' equation with ρ replaced by $\rho(1-\beta)^2$. Accordingly, known solutions of the Navier–Stokes' equation can be applied directly to the present problem if $\beta < 1$; when $\beta > 1$ a simple transformation (reversal of v and P) is necessary to avoid negative densities. It is shown how to obtain by this method the force on a body when the fluid streams past it. As an example, a formula for the total frictional drag coefficient for the two-dimensional flat plate is given. O.Penrose

538.3 : 532.5

11280. PROPAGATION OF WEAK HYDROMAGNETIC DISCONTINUITIES. J.Bazer and O.Fleischman.
Phys. of Fluids, Vol. 2 No. 4, 366-78 (July-Aug. 1959).

A theoretical discussion is given of the propagation of weak hydromagnetic discontinuities (e.g. weak shocks) in an infinitely conducting, perfect, compressible fluid. The undisturbed flow is assumed to be steady and isentropic. As in geometrical optics, the wave-fronts evolving from a given initial manifold — there will be six of them, in general — are constructed by means of rays. In addition, formulae are derived describing the variation of the discontinuity "strength" of a given propagating mode along rays associated with that mode. These results are employed to obtain an explicit solution of a simple mixed initial boundary-value problem that has been designed to illustrate, (1) a method of producing hydromagnetic disturbances, and (2) the fact that an initial disturbance gives rise, in general, to several propagating waves.

538.3 : 532.5

11281. THE BEHAVIOUR OF A [INFINITELY] CONDUCTING [HOMOGENEOUS] GASEOUS SPHERE IN A QUASISTATIONARY ELECTROMAGNETIC FIELD. V.V.Yankov.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 560-4 (1959). In Russian.

The stability of a spherical plasma is investigated using perturbation theory.

538.3 : 532.5

11282. HYDROMAGNETIC WAVES IN PLASMAS. W.O.Schumann.
Z. angew. Phys., Vol. 11, No. 7, 259-64 (July, 1959). In German.

Wave propagation in a plasma subject to an applied magnetic field B is discussed when $eB/m \gg \nu, \omega$ both for ions and electrons, ν being the collision rate. The propagation laws along and transverse to the field are approximately the same for frequencies $\omega \ll \nu$, and are determined almost completely by the heavy positive ions. For small frequencies, the phase velocity depends only upon the Alfvén velocity when $\nu \ll \omega$. R.A.Newing

538.3 : 532.5 : 537.56

IONIC THEORY OF PLASMAS AND MAGNETOHYDRODYNAMICS. See Abstr. 11162

538.3 : 533.16

VARIATION OF THE VISCOSITY OF SOME GAS AND OXYGEN MIXTURES UNDER THE INFLUENCE OF A MAGNETIC FIELD. See Abstr. 10685

ELECTROMAGNETIC WAVES AND OSCILLATIONS

538.561

11283. ON TRANSIENT RADIATION OF A DIPOLE INSIDE A WAVE GUIDE. II. R.Gajewski.
Acta phys. Polon., Vol. 16, No. 1-2, 3-24 (1957).

For Pt I, see Abstr. 8292 (1956). A dipole situated inside a waveguide of an arbitrary cross-section starts oscillating, its moment being $M\,1(t) \sin \omega_0 t$. Asymptotic formulae valid far from the front of the perturbation, are derived for electric and magnetic fields of different modes. An analysis of the pulse propagation leads to the conclusion that, on account of the pulse becoming diffused, a theoretical limit exists for shortening the pulse width.

538.561 : 537.56

CYCLOTRON RADIATION FROM MAGNETICALLY CONFINED PLASMAS. See Abstr. 11164

538.565 : 538.27 : 621.317.61

11284. EXPERIMENTAL PROCEDURE FOR THE DETERMINATION OF CAVITY PARAMETERS. A.Yariv and F.D.Clapp.
Rev. sci. Instrum., Vol. 30, No. 8, 684-7 (Aug., 1959).

A new experimental procedure for the determination of cavity parameters is described. The procedure follows the basic steps described by Slater [Microwave Electronics, Chapter V. Princeton: D. Van Nostrand (1956)]. In this method one measures the frequencies at which the voltage standing wave ratio at the input to the cavity reaches a predetermined value. The knowledge of these frequencies coupled with a determination of the state of coupling to the cavity yields the necessary information. An exposition of some pertinent theoretical points is followed by a detailed description of the experimental procedure.

538.566

11285. THE HIGH-ORDER MODE INTERFEROMETER. J.I.Caicoya.
Onde elect., Vol. 39, 321-8 (April, 1959). In French.

A detailed analysis is presented of the reflection of microwaves at plane surfaces and the generation of high-order modes by interference. The basic experimental system comprises a pair of parallel rectangular plates with variable separation, arranged symmetrically with respect to a reference plane and a third parallel rectangular plate whose position is adjusted independently, to effect the auxiliary reflection required to produce interference. Horns with variable angular position are used as signal source and detector.

538.566 : 535.22

11286. A NEW DETERMINATION OF THE FREE-SPACE VELOCITY OF ELECTROMAGNETIC WAVES. K.D.Froome.
Proc. Roy. Soc. A, Vol. 247, 109-22 (Sept. 9, 1958).

Describes the determination of the velocity in vacuo by means of a millimetre-wave interferometer capable of high precision. The result is $c_0 = 299\,792.50 \pm 0.10$ km/sec, where the variation represents the standard deviation of a single determination in statistical combination with estimated systematic errors.

538.566 : 534.26

11287. THE SCATTERING OF SCALAR WAVES BY A PARABOLOID OF REVOLUTION. K.Klante.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 3-4, 171-82 (1959). In German.

The Watson transformation, developed for the scattering by a sphere, is used here for the scattering by a paraboloid. The decaying of surface waves is expressed as a function of curvature of a surface path, as well as its first and second derivatives. The Dirichlet and the Neumann boundary conditions are both considered.

J.K.Skwirzynski

538.566 : 534.26 : 621.372

SCATTERING OF A PLANE MONOCHROMATIC WAVE BY A SYSTEM OF STRIPS. See Abstr. 10719

538.566 : 621.372

11288. ON THE PLANE-WAVE EXTINCTION CROSS-SECTION OF AN OBSTACLE. A.T.De Hoop.
Appl. sci. Res. B, Vol. 7, No. 6, 463-9 (1959).

A time-harmonic plane electromagnetic wave is incident upon an obstacle of finite dimensions. The properties of the obstacle are such that electromagnetic power is both absorbed and scattered. A close relation exists between the extinction cross-section of the obstacle and the amplitude and phase of the scattered wave in the direction of propagation of the incident wave. The exact form of this relation, the "cross-section theorem", is proved by making use of an explicit representation of the scattered field. The result is valid for a plane wave with arbitrary elliptic polarization. Finally, a similar relation for the scattering of sound waves is given.

538.566

11289. DIFFRACTION AT APERTURES IN NON-PLANE SCREENS. W.Braunbek.
Z. Phys., Vol. 156, No. 1, 66-77 (1959). In German.

Uses the approximate method discussed in Abstr. 6405-6 of 1950. For the special case of a circular aperture in a funnel-shaped screen, the diffraction field on the axis behind the screen is computed for an incident scalar plane wave (different boundary conditions) and for an incident electromagnetic plane wave propagating in the direction of the axis.

538.566

11290. DIFFRACTION OF ELECTROMAGNETIC WAVES USING BRAUNBEK'S APPROXIMATION. I. W.E.Frahn.
Z. Phys., Vol. 156, No. 1, 78-98 (1959). In German.

Braunbek's method (Abstr. 6405-6 of 1950) is extended to electromagnetic waves. The diffraction of a linearly polarized plane electromagnetic wave normally incident on a circular aperture in a perfectly conducting plane screen and on a perfectly conducting plane circular disk is considered in detail. The results are compared with those obtained from the exact solution of Meixner and Andrejewski (Abstr. 7398 of 1959) and with the results of Kirchhoff's approximations. It is shown that, in contrast to the Kirchhoff approximations, Braunbek's method leads in all cases to the correct "optical" limits and represents a good approximation even for wavelengths comparable with the size of the obstacle. After a general formulation of Braunbek's method in the electromagnetic diffraction problem, the far field of the circular aperture and the transmission coefficient are calculated by means of the cross-section theorem.

538.566 : 621.372.823

11291. NEW CALCULATIONS ON THE FARADAY EFFECT IN WAVE GUIDES. A.P.van Gelder, A.M.de Graaf and R.Kronig.
Appl. sci. Res. B, Vol. 7, No. 6, 441-8 (1959).

The propagation of electromagnetic waves is investigated theoretically for a round waveguide containing a gyroelectric-gyromagnetic medium with gyroaxis parallel to the guide in the form of a cylindrical shell of thickness δ, adjacent to the wall of the guide. An equation is set up, for calculating the change in propagation constant γ due to the presence of the shell, including terms proportional to δ^2. Assuming only the presence of gyromagnetism, the change $\Delta_1\gamma$ of first order in δ for TE-waves is determined and is found to be the same for right- and left-circular polarization. The second order difference $\Delta_2^+\gamma - \Delta_2^-\gamma$ for the two senses of polarization, however, appears to have a non-vanishing value which, just as $\Delta_1\gamma$, can be expressed in terms of guide radius, frequency, dielectric constant and the elements of the gyromagnetic permeability tensor which characterize the medium of the shell.

538.566 : 621.372.812

11292. NON-LOCAL REFLECTION IN WAVEGUIDES OF VARYING CROSS-SECTION. V.Pokrovskii, F.Ulinich and S.Savvinykh.
Dokl. Akad. Nauk SSSR, Vol. 124, No. 2, 304-6 (1959) In Russian.

A theoretical investigation into non-local reflection and dissipation due to irregularities in the shape of the waveguide taken as a whole. Only a plane wave is considered. The work uses the mathematical symbols defined in a previous work [Abstr. 5396B of 1958; Dokl. Akad. Nauk SSSR, Vol. 120, No. 3, 504-6 (1958)].

P.Collins

538.566 : 621.396.67

11293. EARTH CURRENTS NEAR A MONOPOLE ANTENNA WITH SYMMETRICAL TOP LOADING. J.R.Wait.
J. Res. Nat. Bur. Stand., Vol. 62, No. 6, 247-55 (June, 1959).

Expressions for the fields are developed for a vertical ground-based monopole with a cone or disk located at the top of the aerial to simulate umbrella top loading. The current distribution on the structure is assumed. Using spherical-wave functions, the magnetic field distribution on the ground plane near the base of the aerial is computed and illustrated by graphs. For the case where the aerial is electrically small, the currents flowing on the cone or disk are shown to contribute only slightly to the total field.

538.566 : 621.396.67

11294. EARTH CURRENTS NEAR A TOP-LOADED MONOPOLE ANTENNA WITH SPECIAL REGARD TO ELECTRICALLY SMALL L- AND T-ANTENNAS. H.L.Knudsen.
J. Res. Nat. Bur. Stand., Vol. 62, No. 6, 283-96 (June, 1959).

An investigation has been made of the ground currents near a top-loaded monopole with nonazimuthal symmetry. Formulae have been developed for the surface current density produced by an inclined, straight wire over a horizontal ground plane for an arbitrary current distribution on the aerial. Working formulae have been developed and numerical calculations of the surface current density on the ground plane have been carried out for the case of a small aerial with a linear current distribution. These results have been used for the calculation of the contribution to the surface current density due to the top loading in the case of an L-aerial and in the case of a T-aerial. In each case both the absolute value of the surface current density arising from the top loading and the relative value of its ϕ-component have been plotted, as it may be expected that this component under certain circumstances may be important in calculating the ground losses in the case of a system of radial ground wires.

538.566.2

11295. THE MAGNETO-IONIC EFFECT IN EARTH–MOON SPACE. I.C.Browne and J.V.Evans.
Jodrell Bank Ann., Vol. 1, No. 5, 255-65 (March, 1958).

Shows that, under certain conditions, the plane of polarization of a radio wave will be rotated as it penetrates the ionized regions in earth–moon space. An expression for the rotation is derived, and by using a model of the most likely distribution of electrons in and above the ionosphere, the rotation produced by different elements of the ray path is investigated. It is found that nearly all the rotation is produced in the ionosphere.

538.566.2

11296. THE PRINCIPLE OF SUPERPOSITION AND THEORY OF DISPERSION. D V.Sivukhin.
Optika i Spektrosk., Vol. 3, No. 4, 297-307 (Oct., 1957). In Russian.

Assuming that displacements and velocities of electric charges in dielectrics and metals acted upon by electromagnetic fields obey the principle of superposition, the author discusses behaviour of permittivity $\epsilon(\omega)$ for real and complex values of frequency ω.

A.Tybulewicz

538.566.2

11297. ON THE ENERGY OF THE ELECTROMAGNETIC FIELD IN DISPERSING MEDIA. D.V.Sivukhin.
Optika i Spektrosk., Vol. 3, No. 4, 308-12 (Oct., 1957). In Russian.

The density of the electromagnetic energy in a non-absorbing, dispersing, isotropic medium is discussed in terms of permittivity $\epsilon(\omega)$ and permeability $\mu(\omega)$ for complex values of frequency ω. The mean rate of propagation of energy in a plane monochromatic wave is also discussed.

A.Tybulewicz

538.569.2 : 621.372.852.3

1298. RAPID INSERTION DEVICE FOR COAXIAL ATTENUATORS.
.Y.Rumfelt and R.J.Como.
ev. sci. Instrum., Vol. 30, No. 8, 687-8 (Aug., 1959).

A rapid insertion device for coaxial attenuators is described. his device is used as an alignment aid when making insertion loss easurements of fixed coaxial attenuators at frequencies up to kMc/s. It provides a quick connect and disconnect feature, main- ins axial alignment of the connectors during joining and separation, d reduces cable flexure. The improved repeatability and accuracy insertion loss measurements is shown by comparative data with fferent alignment techniques.

NUCLEAR AND ATOMIC PHYSICS

APPARATUS . PARTICLE DETECTORS

539.1.07

1299. PARTICLE DETECTORS — COUNTERS AND SCINTIL- .ATORS. THEIR MECHANISM AND CONSTRUCTION. [Détecteurs e particules (compteurs et scintillateurs). Mechanisme et éalisation].
.Blanc.
Paris: Masson et Cie (1959) 323 pp. In French.

Presupposing a knowledge of elementary nuclear physics and f electronics the author gives a comprehensive account of the rinciples and construction of electrical particle detectors. Ion hambers, proportional counters, Geiger counters, vapour-filled nd halogen quenched counters, spark counters, crystal and scintil- ation counters, Cherenkov and discharge-tube counters are dis- ussed in separate chapters. A chapter is devoted to the properties f photomultipliers, of which the principal types and their data are isted. Constructional details of various counters are given. The reatment is mainly descriptive, but important theoretical re- ults applicable to the instruments and affecting their design and se are quoted. Applications of each type of counter to particular xperimental problems are described and special attention is given o the detection of neutrons. The book is fully illustrated and con- ains a very comprehensive bibliography of the subject.

E.G.Michaelis

539.1.07 : 537.533

11300. ON THE INDUCED REVERSE RESPONSE OF THE OXIDIZED ALUMINIUM G—M COUNTER TO VISIBLE LIGHT, THE JOSHI EFFECT, AND THE GEIGER COUNTER SENSITIVITY TO THE AIR-FLUX. B.Sujak.
Acta phys. Polon., Vol. 16, No. 1-2, 49-63 (1957).

A study was made of the induced emission of photoelectrons rom aluminium oxide. It was found that aluminium walled counters vith an oxide layer on the cathode, heated to 500° C for a few hours n atmospheric air, showed a counting-rate run-up effect under visible light following "excitation". This effect is ascribed to the generation of colour centres in the aluminium oxide during the continuous discharge "excitation" period and to the positive charge (ions) on the surface of the oxide layer. After the counting-rate run-up, the counters show a very high background in darkness and a reverse response to light. This reverse response is discussed on he basis of the Joshi effect mechanism. It is held that the Joshi effect is also (at least partly) due to the generation of colour centres n the surface layer of the dielectric (glass cathode). The spectral sensitivity of the induced reverse response to visible light is given. This sensitivity does not depend linearly on the intensity of the illumination. An explanation is also given of the mechanism of the reverse response of the counters to light on the basis of the counter's recovery time. It is shown that a Geiger counter with a negative point point may be operated to be sensitive to an air flux.

539.1.07 : 621.387.424

11301. MEASUREMENTS ON HALOGEN-QUENCHED COUNTERS.
D.H.Le Croissette.
Appl. sci. Res. B, Vol. 7, No. 6, 409-16 (1959).

Measurements were made of the gas amplification factor of a cylindrical counter filled with neon—bromine and argon—bromine mixtures. Information was obtained on the mechanism of gas multiplication when the gas amplification was less than 100. The transit time of electrons across a tube of average dimensions operated in the proportional region was found to be $< 0.2\,\mu s$. The duration and mechanism of the discharge build-up was found to change with the amount of bromine present.

539.1.07

11302. G-M COUNTERS.
K.Van Duuren, A.J.M.Jaspers and J.Hermsen.
Nucleonics, Vol. 17, No. 6, 86-94 (June, 1959).

A review of Geiger-Muller counter characteristics, with special reference to halogen tubes. The discharge mechanism and starting voltage, charge per pulse, dead time, counting efficiency and other properties are discussed. The use of the counters as integrators for dose rate measurements is included and a short bibliography appended.

R.D.Smith

539.1.07

11303. DEPENDENCE OF EFFICIENCY OF AN END-WINDOW COUNTER ON THE HARDNESS OF BETA-SPECTRUM.
I.A.Vasil'ev and K.A.Petrzhak.
Pribory i Tekh. Eksper., 1959, No. 1, 57-61 (Jan.-Feb.). In Russian.

With the help of a 4π-counter, the dependence of the absolute efficiency of an end-window counter on the surface density of the source was investigated experimentally. The relative solid angle was 0.111 and the following sources were used: S^{35}, Ca^{45}, Co^{60}, Ce^{141}, Tl^{204}, Y^{91}. The efficiency dependence on the maximum energy of the beta-emitter is obtained, a relationship which could be useful in measurements of the activity of short-lived products of disintegration.

J.M.Zarzycki

539.1.07

11304. A RUGGED BF_3 PROPORTIONAL COUNTER.
O.F.Swift and R.T.Bayard.
Nucleonics, Vol. 17, No. 5, 122, 124, 126, 128 (May, 1959).

Details of a 1 in. diameter counter for low-level counting. Operation in a high-intensity gamma field has been tested.

R.D.Smith

539.1.07

11305. THE DESIGN, TECHNOLOGY, AND PROPERTIES OF BORON-TRIFLUORIDE PROPORTIONAL COUNTERS.
A.Kazimierski.
Nukleonika, Vol. 4, No. 2, 199-220 (1959). In Polish.

Gives a general review of the progress in the production of BF_3 slow-neutron counters, describing the construction and filling techniques. Discusses the characteristics of counters and pulse amplitude distribution.

J.M.Zarzycki

539.1.07 : 539.164

11306. A DIRECTION-SENSITIVE [PROPORTIONAL] COUNTER AND ITS APPLICATION TO THE $Li^8 \rightarrow Be^{8*}$ DECAY.
K.H.Lauterjung, B.Schimmer, U.Schmidt-Rohr and H.Maier-Leibnitz.
Z. Phys., Vol. 155, No. 5, 560-5 (1959). In German.

The counter was used to measure the angular distribution of the α-particles in the reaction $Li^8 \rightarrow Be^{8*}$. An upper limit of 10% is deduced for the amount of the Fermi contribution in the Li^8 beta-decay.

539.1.07

11307. MULTI-PLATE IONIZATION CHAMBER FOR THE DETECTIONS OF SLOW NEUTRONS.
A.Budzanowski and K.Grotowski.
Acta phys. Polon., Vol. 16, No. 1-2, 135-8 (1957).

The electrodes of the chamber, made in the shape of a multi-plate condenser, are coated with natural boron 3 mg/cm^2 thick. The chamber is filled with argon at a pressure of 1 atm. The chamber efficiency for thermal neutrons is about 2%.

539.1.07 : 537.531

11308. IONIZATION CHAMBER FOR X-RAY DIFFRACTION MEASUREMENTS IN THE PRESENCE OF STRONG RADIOACTIVITY.
L.Hyvärinen.
Ann. Acad. Sci. Fennicae A VI, No. 29, 52 pp. (1959).

Describes in great detail, both from the theoretical and experimental aspect, use of a dynamic set of balanced filters for the discrimination of the background. The X-radiation carrying the desired informations was modulated by applying two kinds of filters alternately at a suitable frequency. An ionization chamber was used as a detector, in which the radioactive radiation appeared as a constant d.c., while the X-radiation appeared as an a.c. component of the ionization current. The shifting of the filters was performed by

mounting them on a rotating disk driven by a motor. An even number of windows was cut along the periphery of the disk and covered alternately with two kinds of filters. J.M.Zarzycki

539.1.07

11309. EFFECTS CAUSED BY THE COLLECTION OF ELECTRONS IN A CYLINDRICAL IONIZATION CHAMBER. G.Hall.
Nuclear Instrum., Vol. 3, No. 3, 121-6 (Sept., 1958). In French.

The effect of using electron collection in a cylindrical, pulse ionization chamber is analysed. Ionizing trajectories crossing the chamber from end to end and ideal conditions are assumed. The probability of observing pulses of a given amplitude is shown to depend on this amplitude. As an example, the resulting statistical distribution of pulse amplitudes to be expected under typical conditions of operation is calculated from Landau's theoretical distribution of energy losses.

539.1.07

11310. CORONA COUNTER FOR THERMAL NEUTRONS. C.W.Peters and F.E.Jablonski.
Rev. sci. Instrum., Vol. 30, No. 8, 728-31 (Aug., 1959).

The characteristics of a double-plate, corona counter with a boron-coated cathode have been investigated with regard to variation of wire spacing, anode-to-cathode spacing, gas flow, and air pressure. A counter designed to detect a thin neutron beam of 0.0002 cm^2 cross-section is described. The sensitivity of each wire in this counter was investigated. This counter was life tested with a nitrogen filling for over 1500 hr or a total of 10^7 counts.

539.1.07

11311. EFFICIENCY OF SCINTILLATION COUNTERS FOR FAST NEUTRONS. F.Lehar.
Czech. J. Phys., Vol. 8, No. 5, 583-91 (1958). In Russian.

Scintillators were made by mixing ZnS:Ag with paraffin wax (see Abstr. 5009 of 1954), polymethylmethacrylate and polystyrene. They were used, together with a photomultiplier RCA6199 and a collimator (Abstr. 4637 of 1954), for the measurement of the efficiency of detection of fast neutrons in relation to: (a) the amount of ZnS:Ag in the mixture; (b) size of ZnS:Ag particles in the mixture; (c) thickness of the scintillator; (d) energy of the neutrons; (e) potential on the photomultiplier. The efficiency for γ-radiation of Co^{60}, Cs^{137} and Ra and its products was also measured. J.M.Zarzycki

539.1.07 : 537.533

11312. THE STUDY OF NOISE PULSES AND A LIQUID SCINTILLATOR. B.P.Singh, H.S.Hans and P.S.Gill.
Indian J. Phys., Vol. 32, No. 4, 183-91 (April, 1958).

Analysis of noise pulses of an RCA photomultiplier 5819 was made with about 350 V between photocathode and first dynode. The differential distribution of noise pulses was studied at different voltages and temperatures. Two distinct distributions are apparent in these curves: one has been interpreted as due to thermal noise and the other due to after-pulses caused by ion feedback. The response of a stilbene-in-xylene liquid scintillator was studied for Co^{60} gamma-rays with high collection efficiency and at low temperature. From the differential distribution of these pulses, the Compton edge due to Co^{60} gamma-rays is clearly indicated.

539.1.07

11313. SCREENS FOR THE RECORDING OF SLOW NEUTRONS. T.V.Timofeeva and S.P.Khormushko.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 1, 14-20 (1958).
In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The work has been concerned with the development of an efficient scintillator for the detection of thermal neutrons against a strong γ-ray background. A zinc sulphide–boron mixture is used, the neutrons being detected by the (n,α) reaction. Of the three methods tried for producing the scintillator mixture, penetration-hardening, mechanical mixing, and sintering, the first gives the best results. The neutron counting efficiency increases with layer thickness and grain size to an optimum, corresponding to a layer thickness of 2-3 grains. The introduction of the scintillator into a varnish reduces the counting efficiency by a factor of 2 to 3. Two types of screens are recommended: a flat one of scintillator powder, and a cylindrical one covered by a scintillator layer on varnish, which gives 3 times the counting efficiency of the flat screen. The latter has a counting efficiency close to the theoretical maximum. J.B.Birks

539.1.07

11314. A SCINTILLATION COUNTER WITH THE TYPE "6" 1 DEVICE [PHOTOMULTIPLIER]. A.F.Vinogradov.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 1, 83-7 (1958).
In Russian. English summary: PB 141041T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The problems associated with the adaptation of gas ionization counter electronic equipment for use with scintillation counters are considered. Instability of the high-voltage supply is the main difficulty, which is overcome by a modification of the method introduced by Scherr and Gerhart [Rev. sci. Instrum., Vol. 23, 770 (1952 using two supporting voltages in the dynode resistor chain. Results have been obtained using the device in scintillation counters for the detection of α-, β- and γ-radiations. J.B.Birks

539.1.07

11315. DIRECTIONAL DEPENDENCE OF THE SCINTILLATION LIGHT OUTPUT FROM ANTHRACENE CRYSTALS UNDER BOMBARDMENT WITH α-RAYS. P.H.Heckmann.
Naturwissenschaften, Vol. 46, No. 8, 259-60 (1959). In German.

With a crystal mounted so that the α-particles (5.3 MeV) enter it perpendicular to the b-axis, the light output is a maximum when the incidence is also perpendicular to the ab-plane, and a minimum when parallel to the a-axis. The ratio of maximum to minimum emission is 1.554. Similarly for incidence perpendicular to the a-axis, the maximum is found perpendicular to the ab-plane and the minimum parallel to the b-axis, with a ratio of 1.224. The anisotropy is not a surface effect and does not occur for a plastic scintillator; it increases for lower energy of α-particles. The variation of output S with angle θ agrees with a theoretical formula of the form

$$(S + a)^{-1} = b + c\,(1 + d\cos^2\theta)^{-\frac{1}{2}},$$

where a, b, c, d are constants. S.T.Henderso

539.1.07

11316. ARE PLATEAUS SIGNIFICANT IN SCINTILLATION COUNTING. R.W.Engstrom and J.L.Weaver.
Nucleonics, Vol. 17, No. 2, 70, 72, 74 (Feb., 1959)

The relationship between counting-rate plateaus, the pulse-height distribution and variation of photomultiplier gain with voltage is analysed. Long plateaus are of less significance than other factors. R.D.Smith

539.1.07 : 621.383.2

11317. AN INTERNATIONAL SURVEY OF PHOTOMULTIPLIERS FOR SCINTILLATION COUNTING. J.Sharpe.
Nucleonics, Vol. 17, No. 6, 82-5 (June, 1959).

Complete characteristics and data are presented in tabular form for 72 phototubes.

539.1.0

11318. RESPONSE OF CsI(Tl) TO p, d, AND α PARTICLES. R.A.Peck, Jr, H.P.Eubank and J.Lowe.
Rev. sci. Instrum., Vol. 30, No. 8, 703-6 (Aug., 1959).

The relation of pulse height in CsI:Tl to particle energy for protons, deuterons and alpha-particles was examined below 20 MeV under a variety of experimental conditions. Observed deviations from simple proportionality (both constant and quadratic terms in a power series representation) depend upon circuit parameters. For a given apparatus, the deviations vary monotonically with the energy interval represented by one spectrometer channel, and tend to zero in the limit of vanishing channel width. The observations suggest that the intrinsic response of CsI:Tl in the limit of vanishing instrumental effects deviates from a straight line through the origin by less than 0.1% per MeV. Observed curvatures, for channel widths of order 0.3-0.6 MeV, are in the range 0.1-1% MeV for both protons and deuterons. Pulse height ratios for given energy are found to be $d/p = 1.04\ (+0.08, -0.02)$ and $\alpha/p = 0.50\ (\pm 0.03)$. Spectrometer peak positions are determined with a precision of 0.1 channel or better by a method of analytic interpolation.

539.1.07 : 778.3

PHOTOGRAPHY OF COSMIC RAY PARTICLES IN FILAMENT OF PLASTIC SCINTILLATOR. See Abstr. 10491

539.1.07 : 535.37

EFFICIENCIES AND PHOTOFRACTIONS FOR GAMMA RADIATION ON SODIUM IODIDE (THALLIUM ACTIVATED) CRYSTALS. See Abstr. 10862

539.1.07 : 537.533

NEW PHOTO[ELECTRON]-MULTIPLIERS. See Abstr. 11111

539.1.07

1319. IMPROVED MEASUREMENT OF ABSOLUTE RATE OF -DISINTEGRATION USING THE 4π-COUNTER TECHNIQUE. .Nath and N.K.Saha.
'roc. Nat. Inst. Sci. India A., Vol. 24, No.4, 256-7 (1958).

The construction of the 4π-counter and the measuring technique f the active-drop-weight have been improved over previous work Proc. Nat. Inst. Sci. India A, Vol. 22, 98 (1956)] resulting in a igher accuracy of measurement of the absolute rate of β-disintegr-tion $(8.31 \pm 0.29)10^6$ disint.min.$^{-1}$ g^{-1}, from a P^{32}-source (3.74 ± 3 er cent μc), prepared in the laboratory.

539.1.07

1320. WALL AND END EFFECTS IN CYLINDRICAL NEUTRON-OLLISION COUNTERS. J.Rembser.
Kukleonik, Vol. 1, No. 5, 167-71 (April, 1959). In German.

The proton spectrum is calculated for a cylindrical neutron ollision chamber of finite dimensions with a filling that includes ydrogen. The calculations explain discrepancies between the con-licting data of Rossi and Staub and those of Skyrme, Tunnicliffe and Vard for end effects in such counters. T.Mulvey

539.1.07

1321. OBSERVATION OF CHARGED-PARTICLE REACTION PRODUCTS. J.M.McKenzie and D.A.Bromley.
Phys. Rev. Letters, Vol. 2, No. 7, 303-5 (April 1, 1959).

Summary of new measurements on the use of Au—Ge junctions or the detection of α-particles. It is found that for protons, He^3 and He^4 ions the output pulse is proportional to incident energy nd independent of specific ionization, provided the particle range s less than the junction thickness of $(6 \pm 0.3) \times 10^{-3}$ cm. The ulse rise-time is found to be less than 3×10^{-9} sec. C.J.Batty

539.1.07

1322. SOME FURTHER STUDIES ON THE APPLICATION OF METHYLENE BLUE IN AQUEOUS SOLUTION AS A DOSIMETER FOR INTENSE BEAMS OF HIGH-ENERGY RADIATION. .Lafuente, S.A.Goldblith and B.E.Proctor.
nternat. J. appl. Radiation and Isotopes, Vol. 3, No. 2, 119-24 (1958).

Aqueous solutions of methylene blue sealed in glass ampoules ave been exposed to γ-radiation, stored at different temperatures nd checked periodically for dye retention for a period of 2 months. The results obtained show that the dye destruction proceeds after rradiation and at a rate dependent on the storage temperature. Parallel tests conducted with non-irradiated samples show small osses of dye, of the order of the experimental error. Another set f experiments using electron beams revealed no practical differ-nces in the extent of dye destruction when the temperature during he irradiation process was varied from 45 to 150° F. Some practical ecommendations are given in order to attain a good degree of eproductibility when using the methylene blue as a radiation dosi-neter. This dosimeter is of value for routine evaluation of electron nd γ-ray beams for: (1) it has a first-order dose response which s linear to at least 6×10^6 rep (using a 1000 mcg/ml solution from $\times 10^6$ to 6×10^6 rep); (2) it is easily measured using common lab-ratory colorimeters; (3) it is temperature independent above the reezing point of water; (4) it is stable for 1 week at refrigerator emperatures.

539.1.07

1323. ENERGY DEPENDENCE OF SILVER PHOSPHATE GLASS DOSIMETERS. A.L.Riegert and J.W.T.Spinks.
nternat. J. appl. Radiation and Isotopes, Vol. 3, No. 2, 125-30 (1958).

The responses of three types of silver phosphate glass dosimeter o X- and γ-radiation show a small energy dependence effect over the nergy region 1.26 to 24 MeV. Dosimeters in the form of thin glass lates exhibit a greater response to low energy X-rays. Increasing he size of the glass element reduces this energy dependence. Other nvestigators have found that by placing suitable lead filters about he glass, the response of the dosimeters was reasonably energy ndependent over the range 100 keV to 1 MeV. It has, however, been ound that the lead filters cause phosphate glass dosimeters to show a high response to X-rays of several MeV in energy.

539.1.07

11324. FLUOROCARBON GAS BUBBLE CHAMBER. .Hahn and G.Riepe.
Rev. sci. Instrum., Vol. 29, No. 2, 184-5 (Feb., 1958).

The properties of a "dirty" bubble chamber using an ethforane-propforane, gas—liquid system are described. The advantages are approximate room temperature operation at moderate pressures. The estimated operating points of some pure fluorocarbons are also given. T.O.Jeffries

539.1.07

11325. SOME LIQUIDS FOR USE IN LARGE BUBBLE CHAMBERS. B.Hahn, G.Riepe and A.W.Knudsen.
Rev. sci. Instrum., Vol. 30, No. 8, 654-5 (Aug., 1959).

The liquids C_3F_8, C_4F_{10}, SF_6, C_2ClF_5, and $CBrF_3$, and mixtures of SF_6 with C_2ClF_5 have been found to possess a number of desirable properties for use in large bubble chambers, designed primarily for particle decay studies. These properties are relatively short radiation length, convenient operating pressure and temperature, chemical inertness, and nontoxicity. Some properties of TeF_6 are also discussed.

539.1.07

11326. INFLUENCE OF THE MEAN DIAMETER OF BACKGROUND GRAINS IN A NUCLEAR EMULSION ON THE STRUCTURE OF GAPS. A.Ishfaq and M.Morand.
C.R. Acad. Sci. (Paris), Vol. 248, No. 12, 1798-800 (March 23, 1959). In French.

The experimental relation between mean gap-length and number of gaps was found to depend on the mean diameter of the background grains. E.J.Burge

539.1.07 : 621.317.39 : 621.397.9

11327. SCANNER RECOGNIZES ATOMIC PARTICLE TRACKS. P.V.C.Hough, J.A.Koenig and W.Williams.
Electronics, Vol. 32, No. 13, 58-61 (March 27, 1959).

The analysis of proton spectrograms involves very laborious microscopic examination of photographic emulsion strips. The machine described is capable of recognizing proton tracks and discriminating against most background effects. Its speed is equivalent to that of twelve men, and its overall accuracy is ±5%. The circuits involved are described in some detail. It is planned to develop the machine to recognize the occurrence of nuclear events. E.A.Ash

539.1.07

11328. THE DISTRIBUTION OF LATENT IMAGES PRODUCED BY β-PARTICLES OF VARIOUS ENERGIES BETWEEN THE SURFACE AND BULK OF SILVER HALIDE GRAINS IN NUCLEAR EMULSIONS. S.Kikuchi.
J. Phys. Radium, Vol. 20, No. 1, 62-4 (Jan., 1959). In French.

For Ilford G5 emulsions, 50 μ thick, exposed to 50-500 keV β-particles, the ratio of the surface to bulk latent image was almost the same as that for light, with the surface image the larger. E.J.Burge

539.1.07 : 621.374.3

11329. NOTES ON A FAST TIME-TO-AMPLITUDE CONVERTER. R.E.Green and R.E.Bell.
Nuclear Instrum., Vol. 3, No. 3, 127-32 (Sept., 1958).

The converter has a full resolution width of 8.5×10^{-10} sec. The circuit is based on the 6BN6 gated beam tube operated at unusually low electrode voltages. An additional supervisory fast coincidence circuit ensures that output pulses are produced only when the pulse delay lies within the desired time interval, thus avoiding the double-valued time-to-amplitude conversion inherent in such systems. Examples of the performance of the apparatus are shown for prompt coincidences and for the delayed coincidence distribution observed when positrons annihilate in fused quartz. The time-to-amplitude converter is easily added to an existing fast-slow coincidence assembly.

539.1.07

11330. TIME-OF-FLIGHT SELECTOR [SPECTROMETER] FOR 14 MeV NEUTRONS [FROM T(d,n)He^4]. G.Deconninck and A.Martegani.
Ann. Soc. Sci. Bruxelles I, Vol. 73, No. 2, 287-94 (1959). In French.

Using the "associated particle" method, a resolution of 2×10^{-9} sec has been reached by means of the Green and Bell time to pulse-height converter circuit (see preceding abstract).

539.1.07

11331. AN AUTOMATIC MEASURING EQUIPMENT FOR MULTIPLE PARTICLE SCATTERING. G.E.Belovitskii, L.N.Korablev, L.V.Sukhov and I.V.Shtranikh.
Pribory i Tekh. Eksper., 1959, No. 2, 86-90 (March-April). In Russian.

Describes an equipment that includes suitable electronic computers, and speeds up scattering measurements and calculations

with photo-emulsions by the coordinate method at least 5 times, ensures greater accuracy and reliability, and is applicable to similar bubble and cloud chamber measurements. A full circuit diagram of the photo pick-up side is included, together with a table showing the improved reliability over non-automatic methods.

D.E.Brown

539.1.07 : 539.14

COINCIDENCE CIRCUITRY FOR NUCLEI LEVEL STRUCTURE STUDY. See Abstr. 10028

539.1.07

11332. DISCUSSION OF A NUMERICAL METHOD FOR THE IMPROVEMENT OF THE RESOLUTION AT A NEUTRON CHOPPER. G.Locke.
Atomkernenergie, Vol. 3, No. 8-9, 299-304 (Aug.-Sept., 1958). In German.

The method permits the computation of a source neutron spectrum $f(\tau)$ from the time distribution of the neutron intensity $m(t)$ measured at the end of the flight path of a chopper. If the measured neutron intensity $m(t)$ varies considerably during a time-of-flight interval, comparable with the length of the neutron pulses, $m(t)$ will differ considerably from $f(t)$ (resonance peaks). Nevertheless, if the time channels are small compared with the neutron pulse length, $f(t)$ can be calculated with fair accuracy. The resolution can thereby be improved by a factor of 5-10.

539.1.07

11333. THE β-RAY SPECTROMETER AT LIÈGE NUCLEAR PHYSICS CENTRE. M.Legros and G.Guében.
Bull. Sci. Assoc. Ingen. Montefiore (A.I.M.), Vol. 72, No. 2, 183-200 (Feb., 1959). In French.

The β-ray spectrometer employs a longitudinal magnetic field, extending only over a small fraction of the trajectory of the particles and thus producing thin lens type of aberrations. Details are given of the vacuum system, the magnetic coil design, the calculated and measured fields, the energy range and focusing properties of the instrument. A.E.I. Research Laboratory

539.1.07

11334. SCINTILLATION SPECTROMETER WITH PULSE SUMMATION FROM TWO CRYSTALS.
J.Kajfosz and J.Kopecký.
Czech. J. Phys., Vol. 8, No. 5, 574-82 (1958). In Russian.

Describes a γ-ray spectrometer working on the following principle. Two crystals are located near each other, the radiation to be detected falling on both. In one of the crystals, the Compton effect is used; in the other, the scattered quantum (energy $E_\gamma - E_e$) is absorbed. By the summation of pulses from both crystals, radiation E_γ can be detected. Efficiency of detection was found to be 3.3% for E_γ = 0.661 MeV and 1.8% for E_γ = 1.255 MeV. The spectrometer shows high purity of the spectrum with resolution (12.3% for E_γ = 0.7 MeV) and linearity similar to that of a single crystal spectrometer. RCA 6342 and Du Mont 6292 photomultipliers and probably two NaI(Tl) crystals were used. J.M.Zarzycki

539.1.07

11335. MAGNETIC GAMMA-SPECTROMETER WITH INCREASED LUMINOSITY. P.T.Prokof'ev.
Latv. PSR Zinat. Akad. Vestis, No. 1 (114), 137-48 (1957). In Russian.

A spectrometer is described which operates in the energy region 200-700 keV and has an energy resolution of 4%. Photoelectrons ejected by γ-rays are focused on a counter by a toroidal magnetic field which collects 23-25% of the electrons of the appropriate energy. G.P.McCauley

539.1.07 : 621.374.3

11336. SHAPING PULSES FOR NUCLEAR SPECTROMETRY.
R.L.Chase.
Nucleonics, Vol. 16, No. 11, 116-19 (Nov., 1958).

The advantages of single or double differentiation or single or double delay line clipping and the effects of d.c. restoring diodes are considered. The shift of the baseline and the effects of pulse pile-up and overloading are small with either double differentiation or double delay line clipping, but the low frequency noise is higher with these circuits. R.D.Smith

539.1.07

11337. COLLIMATOR PENETRATION AND SCATTERING EFFECTS. R.A.Hefferlin and W.E.Kreger.
Nuclear Instrum., Vol. 3, No. 3, 149-57 (Sept., 1958).

The type of lead collimator usually used for gamma-ray spectrometers covering the energy range up to 1 MeV has been found essentially free from scattering; hence, the effective collimator aperture to gamma radiation in certain source–collimator geometries can be calculated according to the theory of Mather (Abstr. 8962 of 1958). The same quantity for a combination of source collimator and detector collimator can likewise be calculated as if the combination were replaced by a continuous collimator of the same total length, providing the units are at least 4 in. and 6 in. long respectively.

539.1.0

11338. TWO-CRYSTAL-COMPTON-SPECTROMETER WITH IMPROVED GEOMETRICAL EFFICIENCY.
P.Weinzierl and G.Tisljar-Lentulis.
Nuclear Instrum., Vol. 3, No. 3, 177-8 (Sept., 1958).

Omitting the gamma-collimator and placing the source between the two crystals improves the efficiency considerably. No disadvantage results from the wider range of scattering angles: no deterioration of the resolution of the Co^{60} lines could be noticed using the improved geometry, compared with the resolution at much greater source–crystal distances. The diameter of the source area was about 5 mm.

539.1.0

11339. COUNTER TELESCOPE EFFICIENCY CALCULATION FOR A NONISOTROPIC NEUTRON SOURCE.
E.Haddad and J.L.Warren.
Rev. sci. Instrum., Vol. 30, No. 8, 664-70 (Aug., 1959).

The measurement of neutron cross-sections with a counter telescope involves a calculation of the telescope efficiency. Equations are derived for a nonisotropic point source of neutrons. The efficiency equations were evaluated for various experimental conditions and the results are presented in tables.

539.1.0

11340. FUNDAMENTAL RELATIONS FOR THE CONSTRUCTION OF MECHANICAL NEUTRON SELECTORS. J.Juna.
Czech. J. Phys., Vol. 8, No. 5, 592-9 (1958). In Russian.

Neutrons of varying velocities may be selected and analysed by means of a rotating sector. Conditions for good transmission and high resolving power are to a certain extent conflicting and optimum operation of the instrument requires careful choice of geometry. Relations governing the size and speed of the sector, the slit width, and the flight distance are accordingly derived.

A.E.I. Research Laboratory

ELEMENTARY PARTICLES

539.1

11341. SOME PROSPECTS FOR THE PRODUCTION AND OBSERVATION OF NEW PARTICLES. B.T.Feld.
Ann. Phys. (New York), Vol. 7, No. 3, 323-48 (July, 1959).

In order to predict the possible existence of new particles, the properties of the known particles, their production and decay characteristics, and some useful schemes for their classification are reviewed. New possibilities are considered through the extrapolation of such schemes, mainly that of Gell-Mann and Nishijima, subject to the conditions that no elementary particle be multiply charged. For each prospect, consideration is given to the decay and production mechanism and the predictions, following from its possible existence are subjected to the available observational information. One is left with two prospects: a strangeness ±2, singlet, charged boson and a strangeness −3, negative, singlet hyperon. Some possible experiments for their production and observation are discussed.

539.1

11342. REMARKS ON THE MASS, ENERGY AND MOMENTUM OF THE PHOTON, ELECTRON AND OTHER ELEMENTARY PARTICLES. J.Picht.
Optik, Vol. 16, No. 5, 257-75 (May, 1959). In German.

539.

11343. MANY-CHANNEL UNITARITY CONDITION. R.H.Cappe
Phys. Rev. Letters, Vol. 2, No. 11, 475-7 (June 1, 1959).

From unitarity and time-reversal invariance an expression is found for the phase of the off-diagonal elements of the S-matrix — a generalization of Watson's theorem. As an example the formula is applied to $\gamma + p \rightarrow p + \pi^0$, taking into account all channels.

J.C.Taylo

539.12

11344. RADIATION OF SPIN 2 PARTICLES WHICH MOVE UNIFORMLY IN A MEDIUM. A.I.Bedritskii.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 339-41 (1959). In Russian.

The energy of the Cherenkov radiation emitted by a spin-two particle is calculated by using a phenomenological theory similar to that which was applied to calculate the effect for an electron. It is found that the radiated energy rises without limit with the initial energy of the particle. T.Roman

539.12

11345. INVESTIGATION ON QUANTUM ELECTRODYNAMICS AT SHORT DISTANCES BY MEANS OF BREMSSTRAHLUNG AND PAIR PRODUCTION. G.Poiani and I.Reina.
Nuovo Cimento, Vol. 13, No. 1, 19-26 (July 1, 1959).

By means of a study of bremsstrahlung and pair production the possibility is examined of extending the limits of the validity of electrodynamics to values beyond those at present known. For this purpose the cross-sections for these processes are calculated by introducing a covariant function which takes account of the form factors relative to the electrodynamic vertices. These calculations are then applied to some cases of experimental tests which would be more sensitive to the limits of electrodynamics.

539.12

11346. ON THE SPATIAL DISTRIBUTION OF THE GAMMA-RAY DOSE FROM A PLANE SOURCE. A.Ya.Margulis and A.V.Khrustalev.
Atomnaya Energiya, Vol. 3, 333 (1957). In Russian.
English translation in: Internat. J. appl. Radiation and Isotopes, Vol. 4, No. 1-2, 109-11 (Dec., 1958).

Formulae and specimen calculations are given for a plane source of negligible thickness and compared with measured values. C.J.Batty

539.12

11347. THE PHOTON—NUCLEON SCATTERING.
S.Minami and Y.Yamaguchi.
Progr. theor. Phys., Vol. 17, No. 5, 651-8 (May, 1957).

The general expressions, the differential cross-section, and the polarization of the recoil nucleon of photon—nucleon scattering are given. Experimental data of photon—nucleon scattering at high energies are analysed in terms of the shadow scattering of the photo-pion production.

539.12

11348. ATTENUATION COEFFICIENTS FOR GAMMA RAYS FROM Co^{60}. K.S.R.Sastry and S.Jnanananda.
J. sci. industr. Res., Vol. 17B, No. 10, 389-94 (Oct., 1958).

Attenuation coefficients in seven different alloys and in Perspex for the 1.1715 and 1.3316 MeV gamma radiations from a 17 mc Co^{60} source have been estimated by the method of least squares, employing the narrow beam geometry of Davisson and Evans with provision for accurate collimation. The experimental values for the coefficients and the theoretical values, expected from the additive law of mass absorption coefficients, agree within 0.25-1.2%. Effective atomic numbers for the total interaction and the three partial effects (photoelectric effect, Compton scattering and pair production) have been obtained for two tungsten steels, sodium iodide and phosphor bronze by interpolation. The results indicate the necessity of different effective atomic numbers to describe the various types of gamma-ray interaction in a mixture of elements.

539.12

11349. ANGULAR CORRELATION AND ANGULAR DISTRIBUTION ATTENUATION COEFFICIENTS.
A.L.Stanford, Jr and W.K.Rivers, Jr.
Rev. sci. Instrum., Vol. 30, No. 8, 719-21 (Aug., 1959).

Attenuation coefficients for angular correlation measurements and angular distribution measurements have been calculated for sodium iodide crystals of 1.5 in.diameter and various heights. The crystals considered are right circular cylinders of heights 1.0, 1.25 and 1.5 in. Eleven photon energies in the range from 0.05 to 5.0 MeV were used. Attenuation coefficients for crystals of diameters other than 1.5 in may be obtained from these results.

539.12

11350. MEASUREMENT OF CIRCULAR POLARIZATION OF γ-RAYS. H.Schopper.
Nuclear Instrum., Vol. 3, No. 3, 158-76 (Sept., 1958).

The various methods are surveyed, and detailed calculations of effects limiting the obtainable accuracy are given.

539.12

11351. MAGNETIC PERTURBATION ON CIRCULAR POLARIZATION OF EXTERNAL BREMSSTRAHLUNG.
A.Bisi and L.Zappa.
Phys. Rev. Letters, Vol. 2, No. 8, 348-9 (April 15, 1959).

The circular polarization of external bremsstrahlung quanta from Y^{90} β-rays, produced in unmagnetized and magnetized iron, was measured as a function of γ-ray energy. At low energies (< 1.4 MeV) the polarization is found to decrease by about 10% when the iron is magnetized. At the high energy end of the spectrum the results indicate that the effect vanishes. C.J.Batty

539.12

11352. FORMATION AND PROPAGATION OF A CHERENKOV CONE. A.Battig.
An. Acad. Brasil. Cienc., Vol. 30, No. 3, 287-94 (1958).

Neglecting non-singular terms in the Fourier integrals of the vector potential, the formation of the Cherenkov cone and its propagation, reflection and refraction at the surface of the dielectric are determined. W.A.Hepner

539.12 : 538.27

11353. STIMULATED EMISSION OF RADIATION BY RELATIVISTIC ELECTRONS IN A MAGNETIC FIELD. J.Schneider.
Phys. Rev. Letters, Vol. 2, No. 12, 504-5 (June 15, 1959).

A formula is deduced for the cyclotron resonance curve for relativistic electrons. For small collision frequency a portion of the curve may lie below the frequency axis, i.e. there may be stimulated emission rather than absorption. The use of this effect in a new type of maser is mentioned. A.Ashmore

539.12

11354. SEARCH FOR AN ELECTRIC DIPOLE MOMENT OF THE ELECTRON. D.F.Nelson, A.A.Schupp, R.W.Pidd and H.R.Crane.
Phys. Rev. Letters, Vol. 2, No. 12, 492-5 (June 15, 1959).

Reports an experiment which sets a new upper limit of 3×10^{-15} cm. $\times$ e on this quantity, and describes proposed improvements. R.J.N.Phillips

539.12

11355. SCATTERING OF ELECTRONS WITH AN INTRINSIC ELECTRIC DIPOLE MOMENT.
B.Margolis, S.Rosendorff and A.Sirlin.
Phys. Rev., Vol. 114, No. 6, 1530-3 (June 15, 1959).

The elastic scattering of electrons with a small intrinsic electric dipole moment (e.d.m.) by spinless targets is discussed in the first and second Born approximations. For large momentum transfer ($q \sim 500$ MeV/c) the e.d.m. contribution to the elastic scattering cross-section becomes important even for values $\lambda \sim 10^{-3}$ (where λ is the e.d.m. in units of e times the Compton wavelength of the electron). Thus, it seems likely that experiments involving high-energy electrons may give valuable information on the hypothetical existence and upper limit of the e.d.m. interaction. It is also found, in the first Born approximation, that at sufficiently high energies the existence of the e.d.m. can change the polarization of the electron beam from longitudinal to transverse. Finally, asymmetry effects which appear in the second Born approximation are discussed in detail. Detection of these asymmetries or of the spin correlation effects of the first Born approximation mentioned above would imply the noninvariance of the electromagnetic interactions under parity and time reversal.

539.12

11356. DETERMINATION OF ELECTRON POLARIZATION BY MEANS OF MOTT SCATTERING. N.Sherman and D.F.Nelson.
Phys. Rev., Vol. 114, No. 6, 1541-2 (June 15, 1959).

The results of a numerical calculation of the polarization asymmetry factor, $S(\theta) = [\delta(\theta)]^{1/2}$, and the single scattering cross-section for the scattering of electrons by the unscreened Coulomb fields of gold and aluminum at energies of 75 keV and 121 keV are presented. The results for gold at 121 keV are compared with the Mohr and Tassie calculations for the same element and energy which include the effects of screening. This comparison (indicating a Mott asymmetry about 50% greater for the screened field at angles near 165^0) suggests the desirability of more detailed investigation of screening effects in order to be confident of Mott scattering as a means of measuring the polarization of electrons in this energy region.

539.12

11357. POLARIZATION EFFECTS IN SCATTERING ELECTRONS BY PROTONS. G.V.Frolov.
Zh. eksper. teor. Fiz., Vol. 34. No. 3, 764-6 (1958). In Russian. English translation in: Soviet Physics — JETP (New York), Vol. 34(7), No. 3, 525-6 (Sept., 1958).

The polarization of electrons and the recoil protons resulting from the scattering of polarized electrons by polarized protons is calculated, whereby it is possible to determine the two real, first order approximation form-factors of the proton structure.

S.J.St-Lorant

539.12

11358. EFFECT OF A PION–PION SCATTERING RESONANCE ON NUCLEON STRUCTURE. W.R.Frazer and J.R.Fulco.
Phys. Rev. Letters, Vol. 2, No. 8, 365-8 (April 15, 1959).

It is shown that the difficulty in fitting simultaneously the magnetic moment and the radii of the charge and moment distributions of nuclei can probably be removed if it is assumed that there is an attractive $\pi-\pi$ interaction which has a suitable resonance.

E.J.Squires

539.12

11359. FORCES BETWEEN NUCLEONS AND ANTINUCLEONS. G.F.Chew.
Proc. Nat. Acad. Sci. U.S.A., Vol. 45, No. 4, 456-61 (April, 1959).

Assuming the nucleon–nucleon interaction is understood at large and intermediate distance in terms of the pion cloud, the corresponding nucleon–antinucleon interaction is deduced applying the principle of charge conjugation. Thus the sign changes to contributions involving the exchange of an odd number of pions, and remains the same when an even number are exchanged. The repulsive core of the nucleon–nucleon interaction, with a radius approximately equal to the nucleon Compton wavelength, is replaced by a black hole which gives the annihilation. Experimental results at intermediate energies include total cross-sections for elastic scattering, charge-exchange scattering, and annihilation, and angular distributions for elastic scattering. The theoretical model gives satisfactory agreement with these experimental results. The proton–antiproton cross-sections correspond much better with the range of a pion Compton wavelength than do the nucleon–nucleon cross-sections. In the latter case, cancellations occur between the repulsive core and the attractive region outside it, and also between the one pion and two pion exchange regions. These cancellations are eliminated by sign reversals in nucleon–antinucleon scattering. The annihilation cross-sections at intermediate energies are several times higher than would be expected from the size of the core. This is presumed to be due to antiprotons being deflected into the core by the pion cloud. For very high energy antiprotons the true size of the core should be apparent. A.Ashmore

539.12

11360. FIXED ANGLE DISPERSION RELATIONS FOR NUCLEON–NUCLEON SCATTERING. M.Cini, S.Fubini and A.Stanghellini.
Phys. Rev., Vol. 114, No. 6, 1633-9 (June 15, 1959).

Dispersion relations in which the scattering angle θ is kept constant are proposed for nucleon–nucleon scattering. These relations are a direct consequence of a general representation proposed by Mandelstam (Abstr. 4941 of 1959) and can be checked directly up to the fourth-order perturbation theory. An extrapolation procedure based on these dispersion relations is proposed with the purpose of obtaining an independent determination of the pion–nucleon coupling constant and the possibility of discriminating between the different available sets of phase shifts. A first determination of the pion–nucleon coupling constant from these fixed-angle dispersion relations is attempted by means of a more direct extrapolation procedure, closely analogous to the effective range approximation, and a result in good agreement with the currently accepted value is obtained.

539.12

11361. NUCLEON–DEUTERON SCATTERING WITH TENSOR FORCES. B.H.Bransden, K.Smith and C.Tate.
Proc. Roy. Soc. A, Vol. 247, 73-91 (Sept. 9, 1958).

The theory of the elastic scattering of neutrons or protons by deuterons is formulated. It is assumed that the two-body interaction is a mixture of central and tensor components, and the resonating group method is used to derive coupled integro-differential equations for the wave functions of relative nucleon–deuteron motion. The differential cross-section is expressed in terms of eigenphase shifts and mixing parameters, which may be calculated from the asymptotic form of the solutions of these equations.

539.12 : 539.1

11362. THE ELECTRICAL POLARIZABILITY OF THE MESON CLOUD IN THE NUCLEON. V.S.Barashenkov and B.M.Barbashov.
Nuclear Physics, Vol. 9, No. 3, 426-8 (Jan. (1), 1959).

The electrical polarizability of the meson cloud in the nucleon is calculated by first order Chew theory. The result is only slightly sensitive to the form factor, and a polarizability of about 1.6×10^{-42} cm^3 is obtained. This value is compared with values deduced from various experiments. E.J.Squires

539.12

11363. A FREE PRECESSION DETERMINATION OF THE PROTON GYROMAGNETIC RATIO. P.L.Bender and R.L.Driscoll.
I.R.E. Trans Instrumentation, Vol. I-7, No. 3-4, 176-80 (Dec., 1958).

A determination of the proton gyromagnetic ratio was made in a magnetic field of about 12 gauss. A water sample was polarized in a strong magnetic field and then fired through a pneumatic tube into a precision solenoid. After arrivel the protons were reoriented by about 90° with respect to the solenoid field by a r.f. pulse and the subsequent free precession signal induced in a pick-up coil was observed. Short term fluctuations in the earth's field and in the solenoid current gave a scatter of about one part per million in individual frequency measurements. A preliminary value of $\gamma_p = (2.67513 \pm 0.00002) \times 10^4$ gauss^{-1} sec^{-1} was found for the gyromagnetic ratio of protons in water, uncorrected for diamagnetism. Radiation damping of the free precession signals is strong under certain conditions and can cause small frequency shifts.

539.12

11364. THE INTERACTION OF 9 BeV PROTONS WITH FREE AND BOUND NUCLEONS IN PHOTOGRAPHIC EMULSION.
N.P.Bogachev, S.A.Bunyatov, Yu.P.Merekov and V.M.Sidorov.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 4, 617-20 (1958). In Russian.

Results based on 1308 events in emulsion are reported. Of these 178 were identified as interactions with single nucleons of the emulsion, either bound in carbon, or free hydrogen nuclei. The p–p elastic cross-section was found to be 10 ± 4 mb, with an angular distribution consistent with scattering from a black sphere of radius about 1 fermi, though the statistics are poor. The p–p inelastic cross-section was estimated at 30 mb, and the mean number of charged secondaries was found to be about 3.4 per event. Histograms are given of the angular distributions of the secondaries. The mean free path of 9 BeV protons in the emulsion is 37.1 ± 1.0 cm.

G.P.McCaul

539.1

11365. POSITIVE PION PRODUCTION IN PROTON–PROTON COLLISIONS AT 450 MeV. L.G.Pondrom.
Phys. Rev., Vol. 114, No. 6, 1623-32 (June 15, 1959).

The external proton beam of the Chicago cyclotron was used to study the reaction $p + p \rightarrow \pi^+ + n + p$ at 450 MeV. The reaction $p + p \rightarrow \pi^+ + d$ was also measured as a check on the equipment. A double focusing wedge magnet was used to observe the momentum distribution of pions at angles of 14°, 20.5°, and 30° in the laboratory system. The over-all resolution of the magnet system varied from 1.5% to 2.2%. A least squares fit of the $p + p \rightarrow \pi^+ + d$ data in the centre-of-mass system gives $d\sigma/d\Omega\alpha$ $(0.38 \pm 0.20 + \cos^2\theta)$ with $\sigma = 1.47 \pm 0.12$ millibarns. The spectra for the unbound reaction were fitted to Ss, Sp, Ps, and Pp spectrum shapes predicted by the phenomenological theory of pion production. This fit gives $d\sigma/d\Omega$ $(0.40 \pm 0.08 + \cos^2\theta)$ with $\sigma = 1.80 \pm 0.7$ mb. The results of this fit have been compared with the cross-section for neutral pion production at 450 MeV. This comparison was found satisfactory for the amounts of the Ss, Sp, and Pp spectrum shapes found in this experiment, but an excessively large amount of the Ps shape, 0.38 ± 0.10 m was required to fit the data. The results show that σ_{10}(Pp) is much smaller than has been previously reported. An excitation function for the unbound cross-section is predicted by this fit in terms of the phenomenological model, and is found to increase too rapidly at high bombarding energies.

539.1

11366. p–p TRIPLE SCATTERING AT 143 MeV. C.F.Hwang, T.R.Ophel, E.H.Thorndike, R.Wilson and N.F.Ramsey.
Phys. Rev. Letters, Vol. 2, No. 7, 310-12 (April 1, 1959).

Results are given for the angular distribution of the triple scattering parameter D in p–p scattering at 143 MeV. They are in marked disagreement with those of Taylor and Wood (1958 CERN conference) at 150 MeV, but similar to those of Chamberlain et. al (see Abstr. 3371 of 1957) at 315 MeV and of Kumekin et. al (1958 CERN conference) at 635 MeV. The present measurements and the

f Taylor and Wood are respectively in agreement with the predic-ons of the potentials of Gammel and Thaler, and of Signell and farshak. The variation with energy should be slight for potentials ontaining no terms of higher order than linear in momentum.
A.Ashmore

539.12

.367. NON-UNIQUENESS OF PHASE SHIFT ANALYSIS OF ROTON–PROTON COLLISIONS.
.S.Barashenkov and Khuan Nyan'-Nin.
h. eksper. teor. Fiz., Vol. 36, No. 3, 832-4 (1959). In Russian.
A method, based on the optical model, is proposed for the phase nalysis of collisions at energies $E \leq 10$ BeV. At energies ~ 1 BeV the refractive and absorption coefficients are found to e of the same order of magnitude. The calculated differential ross-sections for elastic scattering and also the total cross-ection and cross-section for inelastic processes agree with xperimental data.

539.12

1368. ANTIPROTON INTERACTION CROSS SECTIONS.
.G.Ekspong and B.E.Ronne.
uovo Cimento, Vol. 13, No. 1, 27-45 (July 1, 1959).
A study has been made of 374 antiproton tracks in nuclear mulsions in the energy region (0-250) MeV. A path length of 7.3 m has been followed. Ten new elastic $\bar{p}$–p scattering events gather with eleven events published earlier yield an elastic cattering cross-section of (77 ± 17) mb. The total and the differen-al elastic cross-sections are consistent with the theory by Chew nd Ball. The mean free path for annihilation in the energy region) to 250 MeV is (20.8 ± 1.6) cm, and the interaction mean free path (18.3 ± 1.3) cm. An effective antiproton–nucleon cross-section (150^{+37}_{-22}) mb has been deduced from an optical model calculation. ix new inelastic scattering events are reported. Putting these gether with the 8 or 9 events published by Goldhaber et al. one ets an inelastic scattering cross-section of (42 ± 11) mb per emul-ion nucleus (hydrogen excluded). The low value of the cross-section discussed in the light of the optical model. The elastic scattering n complex nuclei seems to agree with a combination of Rutherford nd diffraction scattering from a completely absorbing nucleus.

539.12

1369. EXPERIMENTAL DETERMINATION OF THE NONMAG-ETIC NEUTRON–ELECTRON INTERACTION.
.Melkonian, B.M.Rustad and W.W.Havens,Jr.
hys. Rev., Vol. 114, No. 6, 1571-6 (June 15, 1959).
A precise set of measurements of the variation of the trans-nission of liquid bismuth with energy in the range 0.1 eV to 10 eV as made. After correction for neutron capture, Doppler effect nd liquid diffraction, a value of $V_0 = -4.34 \pm 0.14$ keV is obtained s the depth of the potential well having a radius equal to the lassical electron radius. This gives -0.26 ± 0.14 keV as the trength of the intrinsic neutron–electron interaction after subtrac-on of the Foldy term.

539.12 : 539.19

1370. THEORETICAL CALCULATIONS OF THE SLOW NEUTRON CATTERING CROSS SECTION OF THE ETHYLENE MOLECULE.
.A.Janik, F.Maniawski and H.Rżany.
cta phys. Polon., Vol. 17, No. 6, 489-90 (1958).
Calculations of the scattering of slow neutrons from ethylene re compared with the experimental values of Melkonian. The scat-ering cross-sections were calculated from the equation of Krieger nd Nelkin. Good agreement was obtained in the energy range .005 eV to 0.07 eV, but small deviations occur above 0.07 eV. nce the lowest known excited vibrational level of the C_2H_4 mole-ule occurs at 0.10 eV, it is suggested that the assumption of a level wer than 0.10 eV could resolve this difficulty.
A.E.I. Research Laboratory

539.12

1371. HIGH ENERGY NEUTRON–PROTON SCATTERING WITH PIN–ORBIT INTERACTION. H.N.Yadav and L.S.Singh.
ndian J. Phys., Vol. 32, No. 2, 80-90 (Feb., 1958).
The angular distribution and total cross-sections have been alculated for high energy n–p scattering in the energy-range 3-415 MeV (laboratory system). The interaction considered is f a symmetrical type with spin–orbit and tensor force in the riplet states. Yukawa potential has been used with ranges 1.18×10^{-13} and 1.60×10^{-13} cm, respectively, in the singlet and triplet tates. The parameters of the potential are fitted to explain the low-energy scattering cross-section and the properties of the deuteron. The calculated high-energy cross-sections are, as usual, large. The symmetrical meson theory with tensor force and spin–orbit interaction does not seem to be capable of explaining the high-energy scattering data.

539.12

11372. NOTE ON THE THERMAL NEUTRON SPECTRUM IN A DIFFUSING MEDIUM. G. de Coulon and P.F.Zweifel.
Nuclear Sci. Engng, Vol. 5, No. 3, 203-4 (March, 1959).
Doubts are expressed as to whether the assumption of flux separability is valid in two problems considered by Hurwitz and Nelkin. The first problem is that of the steady-state diffusion of neutrons from a thermal plane source in an infinite medium, and the second is that of the time-dependence of the thermal flux following a pulse of fast neutrons.
J.F.Hill

539.12

11373. THE GENERAL PROBLEM OF SLOWING-DOWN NEUTRONS. M.V.Maslennikov.
Dokl. Akad. Nauk SSSR, Vol. 118, No. 2, 259-62 (Jan. 11, 1958).
In Russian. English translation in: Soviet Physics–"Doklady" (New York), Vol. 3, No. 1, 40-3 (Jan.-Feb., 1958).
An integral equation for the phase-space density of neutron collisions is set up, and the solution is discussed under certain restrictive assumptions.
R.J.N.Phillips

539.12

11374. ATTENUATION OF 14 MeV NEUTRONS IN WATER AND IN 6 in. LEAD AND WATER.
V.P.Duggal, S.M.Puri and K.Sri Ram.
Nuclear Sci. Engng, Vol. 5, No. 3, 199-200 (March, 1959).
Fast flux and resonance neutrons are attenuated at the same rate in both cases. The flux is assumed to fall off as $[\exp(-R/L)]/R^2$, giving a relaxation length L of 13.6 ± 0.5 cm for R between 60 and 70 cm.
J.W.Sturgess

539.12

11375. NEUTRON–PROTON CAPTURE CROSS SECTION.
R.W.Stooksberry and M.F.Crouch.
Phys. Rev., Vol. 114, No. 6, 1561-3 (June 15, 1959).
The mean lifetime of thermal neutrons in water was measured with a large moderator (radius ~ 7 diffusion lengths), for which the correction for escape was only about 5%. The geometry was such that the perturbing effect of the immersed BF_3 neutron detector could be almost rigorously calculated. The value obtained is $\tau = 206.3 \pm 5.0$ μsec, giving the neutron–proton capture cross-section as $(0.330 \pm 0.008) \times 10^{-24}$ cm^2. A possible systematic error from higher modes in the neutron distribution is discussed.

539.12 : 530.145

QUANTUM FIELD THEORY OF UNSTABLE PARTICLES.
See Abstr. 10602

539.12

11376. REMARK ON STRONG INTERACTIONS. S.Barshay.
Phys. Rev. Letters, Vol. 2, No. 7, 315-18 (April 1, 1959).
It is suggested that it is unreasonable to use the doublet approximation of Pais (Abstr. 3704 of 1958; 2624 of 1959) as a basis for classifying the meson–baryon interactions, since the selection rules which it predicts are violated so strongly in known reactions. A division of the meson–baryon interactions into two classes, non-strange baryons with π and K mesons (I), and strange baryons with π and K mesons (II), is discussed. There is considerable experimental information about the interactions in (I) but little can be deduced at present about those in (II). Some suggestions are given for reactions which would give further information about the latter.
E.J.Squires

539.12

11377. ON THE POSSIBILITY OF NEUTRONS PRODUCING SECONDARY INTERACTIONS IN HIGH ENERGY SHOWERS.
P.K.Aditya.
Nuovo Cimento, Vol. 11, No. 6, 872-5 (March 16, 1959).
The method used by Brisbout et al. (Abstr. 2619 of 1957) to determine the relative proportions of π-mesons, K-mesons, hyperons and nucleon–antinucleon pairs among shower particles produced in high-energy events by studying neutral rather than charged particles is re-analysed. It is shown that neutral projectiles arising from charge exchange scattering or due to composite primaries can account for nearly all the secondary neutral

interactions observed by Brisbout et al., and that their method is therefore liable to overestimate the proportion of heavy particles produced in the interaction. E.G.Michaelis

539.12 : 537.54

PRODUCTION OF ELEMENTARY PARTICLES IN THE LABORATORY. See Abstr. 11139

539.12

11378. THE POLARIZATION OF A MUON BEAM ARISING FROM THE DECAY OF PIONS IN FLIGHT. J.H.D.Jensen and H.Øveräs.
K. Norske Vidensk. Selsk. Forhandl., Vol. 31, No. 6, 34-8 (1958). In German.

The Lorentz transformation of the polarization vector of muons arising from pion decay is discussed using the density matrix. Expressions for the angle between the polarization vector and the muon momentum are derived. E.G.Michaelis

539.12

11379. SEARCH FOR THE DECAY $\mu^+ \rightarrow e^+ + \gamma$.
H.F.Davis, A.Roberts and T.F.Zipf.
Phys. Rev. Letters, Vol. 2, No. 5, 211-13 (March, 1959).

The probability that the branching ratio

$$\rho = \frac{\mu \rightarrow e + \gamma}{\mu \rightarrow e + \nu + \bar{\nu}}$$

exceeds 1×10^{-6} is found to be less than 0.5. C.J.Batty

539.12

11380. UPPER LIMIT FOR THE DECAY MODE $\mu \rightarrow e + \gamma$.
D.Berley, J.Lee and M.Bardon.
Phys. Rev. Letters, Vol. 2, No. 8, 357-9 (April 15, 1959).

The branching ratio $(\mu \rightarrow e + \gamma)/(\mu \rightarrow e + \nu + \bar{\nu})$ has been measured to be less than 2×10^{-6}, with a 90% confidence level. R.J.N.Phillips

539.12

11381. CORRECTIONS TO THE 3D–2P TRANSITIONS IN μ-MESONIC PHOSPHORUS AND THE MASS OF THE MUON.
A.Petermann and Y.Yamaguchi.
Phys. Rev. Letters, Vol. 2, No. 8, 359-61 (April 15, 1959).

With the current lower limit on the muon mass, the experimental muon magnetic moment disagrees with theory. A careful examination is made of the theoretical corrections needed in determining this lower limit. R.J.N.Phillips

539.12

11382. PRECISE DETERMINATION OF THE MUON MAGNETIC MOMENT. R.L.Garwin, D.P.Hutchinson, S.Penman and G.Shapiro.
Phys. Rev. Letters Vol. 2, No. 5, 213-15 (March 1); erratum, No. 12, 516-17 (June 15, 1959).

Measurement using a strcboscopic method. The value found for the g-factor, using a value for the lower limit of the μ-meson mass, is $g_\mu > 2(1.00\,122 \pm 0.00\,008)$ which is in good agreement with theoretical predictions. Possible systematic errors are considered in detail. C.J.Batty

539.12

11383. NATURE OF THE VECTOR INTERACTION IN μ^--ABSORPTION. S.Weinberg.
Phys. Rev. Letters, Vol. 2, No. 5, 223-4 (March 1, 1959).

It is shown that information on the reaction $\mu^- + A \rightarrow \nu + B$ and the inelastic electron scattering process $e + A \rightarrow e + A^*$ can, for suitable nuclei, give a critical test of the Feynman–Gell-Mann theory (Abstr. 507 of 1958) for muon interactions. C.J.Batty

539.12

11384. INVESTIGATION ON THE LARGE ANGLE SCATTERING OF MUONS IN COPPER. M.M.Biswas
Z. Phys., Vol. 155, No. 5, 518-23 (1959).

Reports the observation of large-angle scattering above 1 BeV/c, studied in a cloud chamber $18 \times 18 \times 7$ in. The result favours the Mollère theoretical distribution based on a point charge model of the nucleus and is not in agreement with Olbert's uniform nuclear model.

539.12

11385. THE MULTIPLICITY OF MESONS PRODUCED IN THE NUCLEAR INTERACTION OF HIGH ENERGY NUCLEONS AND α-PARTICLES IN COSMIC RADIATION. S.Kaneko.
J. Phys. Soc. Japan, Vol. 13, No. 11, 1258-65 (Nov., 1958).

It was proposed in a previous paper (Abstr. 6154 of 1958), that the multiplicity $n_\pm$ of charged mesons produced in the high energy nucleon–nucleon interaction can be empirically expressed as a function of the inelasticity K and the Lorentz factor γ_c in the centre-of-mass system: $n_\pm \cong 3.5\,K(\gamma_c - 1)$ for $\gamma_c < \sim 7$, $n_\pm \cong 9\,K(\gamma_c - 1)^{1/2}$ for $\gamma_c > \sim 7$. It is shown here that further experimental results published in recent years are also consistent with this dependence. It is also suggested, with the support of experimental material, that the peripheral collision of high energy α-particles with nuclei can be explained in terms of a superpositio of a few nucleon–nucleon collisions so that the meson multiplicity in the interaction can also be represented by the above equations. The results of observation of a jet ($3 \cdot 3\sigma_\alpha$) initiated by a high ene α-particle ($\cong 1.2 \times 10^{13}$ eV/nucleon) are described.

539.

11386. THE POSSIBLE MULTIPLE PRODUCTION OF μ-MESONS
I.L.Rozental'.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 943-5 (1959). In Russian.

Arguments are advanced in favour of this hypothesis [Rozental and Chernavskii, Uspekhi Fiz. Nauk, Vol. 52, 185 (1954)]. P.K.Kab

539.

11387. RESONANCES IN THE π–HYPERON SYSTEM.
M.Nauenberg.
Phys. Rev. Letters, Vol. 2, No. 8, 351-2 (April 15, 1959).

Possible resonances have been studied, using the Chew–Low approximation for scattering with the charge-symmetric $\pi\Sigma\Lambda$ and $\pi\Sigma\Sigma$ interactions. R.J.N.Phill

539.1

11388. ANALYSIS OF BUBBLE-CHAMBER PHOTOGRAPHS AND THE APPLICATION TO PION–PROTON SCATTERING.
I.Derado, G.Lütjens and N. Schmitz.
Ann. Phys. (Leipzig), Folge 7, Vol. 4, No. 1-5, 103-20 (1959). In German.

Reports on a series of measurements of the total cross-secti for pion–proton scattering at 1.14 GeV/c in a hydrogen bubble-chamber. The momentum distribution in the c.m. system, of the secondary particles in the reactions

$$\pi^- + p \rightarrow \pi^- + p + \pi^0$$
$$\pi^- + p \rightarrow \pi^- + n + \pi^+$$

are presented. The analysis includes the computation of a correc tion factor for each event and attempts to separate the events into different reaction classes. S.J.St-Lorar

539.1

11389. POSSIBLE RESONANT STATE IN PION–HYPERON SCATTERING. R.H.Dalitz and S.F.Tuan.
Phys. Rev. Letters, Vol. 2, No. 10, 425-8 (May 15, 1959).

It is argued that the low-energy K^-–p scattering data may indicate a pion–hyperon resonance at about 20 MeV below the K^-–p threshold energy. Means of establishing its presence and properties are discussed. R.J.N.Phill

539.

11390. π^-/π^+ RATIO FROM DEUTERIUM IN PHOTOPRODUCTIC AT 500-1000 MeV. G.Neugebauer, W.D.Wales and R.L.Walker.
Phys. Rev. Letters, Vol. 2, No. 10, 429-30 (May 15, 1959).

Presents a preliminary analysis of the change in the ratio of cross-sections with energy of the two processes

$$\gamma + p \rightarrow n + \pi^+$$

$$\gamma + n \rightarrow p + \pi^-$$

in deuterium. The energies corresponding to photoproduction fro free nucleons by photons extend from 500-1000 MeV in steps of 100 MeV, and results are given for the ratio at centre-of-mass a of 40°, 90°, 120° and 150°. S.J.St-Lor

539

11391. K_{μ_3} DECAY AND LEPTONIC DECAY OF HYPERONS.
B.Sakita.
Phys. Rev., Vol. 114, No. 6, 1650-1 (June 15, 1959).

The partial lifetime of $K \rightarrow \mu + \nu$ is calculated by dispersion techniques assuming that the K meson is pseudoscalar and that the relevant Fermi interactions are of the V–A type. The result are compared with experiments and it is concluded that the re-normalized axial vector coupling which is responsible for the leptonic decay of hyperons is much smaller than the usual univer Fermi interaction.

539.12

11392. THE PARITY OF K-MESONS AND DISPERSION RELATIONS. M.M.Islam.
Nuovo Cimento, Vol. 13, No. 1, 224-7 (July 1, 1959).

An attempt to deduce the K-meson parity from dispersion relations, using available data on K—N scattering. J.C.Taylor

539.12

11393. PARITY OF THE K MESON AND THE Λ BETA-DECAY BRANCHING RATIO. C.H.Albright.
Phys. Rev., Vol. 114, No. 6, 1648-50 (June 15, 1959).

The related problems of Λ beta decay and $K_{\mu 2}$ decay (via a Λ-antiproton loop) are studied. Dispersion techniques are used to calculate the vector (axial vector) Fermi interaction coupling constant from the known $K_{\mu 2}$ lifetime and reasonable values of the strong coupling constant for the scalar (pseudoscalar) K case. Each weak coupling constant is then used to place a lower limit on the Λ beta-decay branching ratio with the result that the limit with a pseudoscalar K is more than one order of magnitude smaller than that with a scalar K meson. The present meagre experimental information is essentially consistent with either K parity, for the observed branching ratio is approximately equal to the lower limit predicted for the scalar K case.

539.12

11394. EFFECT OF K^0—K^- MASS DIFFERENCE ON K^-—N INTERACTIONS AT LOW ENERGIES. J.D.Jackson and H.W.Wyld, Jr.
Nuovo Cimento, Vol. 13, No. 1, 85-95 (July 1, 1959).

The R matrix formalism of Wigner and Eisenbud is used to modify the zero range S wave analysis of the scattering and absorption of K^--mesons on protons proposed by Jackson, Ravenhall and Wyld so as to take into account the kinematical effects of the K^0—K^- mass difference. It is found that even with a mass difference, the elastic, charge exchange, and absorption cross-sections can be expressed in terms of two complex scattering lengths. The elastic and absorption cross-sections exhibit cusps at the threshold for charge exchange scattering. The shape of the cusps can be used to distinguish between otherwise indistinguishable sets of scattering lengths. If the K^0 and K^- have opposite parities there is no cusp in the elastic scattering cross-section, so that in principle it is possible to determine the relative parity of K^0 and K^- from the energy dependence of the K^- scattering cross-section.

539.12

11395. NEGATIVE K MESON—NUCLEON INTERACTION AT LOW ENERGIES. J.C.Jackson and H.W.Wyld, Jr.
Phys. Rev. Letters, Vol. 2, No. 8, 355-7 (April 15, 1959).

Shows that the peaking of the elastic K^-—p cross-section at low energies may be explained by Coulomb interference, provided the K^-—p interaction is "repulsive" in the usual sense.
R.J.N.Phillips

539.12

11396. INTERACTIONS OF 1.15 BeV/c K^- MESONS IN EMULSION. W.H.Barkas, N.N.Biswas, D.A.DeLise, J.N.Dyer, H.H.Heckman and F.M.Smith.
Phys. Rev. Letters, Vol. 2, No. 11, 466-8 (June 1, 1959).

Results are given of the analysis of stars produced by 1.15 BeV/c K^- mesons in a stack of Ilford K5 emulsion. In an unbiased sample of 102 stars 7 hyperfragments, 25 $\Sigma^\pm$, 7 π pairs, 35 single π and 3 inelastic K^- were found. In a selected sample of 56 stars from which strange particles emerge there were 17 hyperfragments, 24 $\Sigma^\pm$, 5 inelastic K^-, 4 Σ pairs. Only one of these stars had the features for the emission of a cascade hyperfragment and this was not confirmed. There were 7 cases of π pair emission, 6 accompanied by Σ's. A.Ashmore

539.12

11397. A FIXED-SOURCE APPROACH TO SCATTERING OF KAONS. W.Królikowski.
Bull. Acad. Polon. Sci. math. astron. phys., Vol. 7, No. 4, 237-44 (1959).

The methods developed by Chew and Low (Abstr. 2680 of 1956) for π—N scattering are here applied to K—N and $\bar{K}$—N scattering. Account is taken of the baryon mass differences. The possibility of a similarity between the Λ and Σ couplings is mentioned. An effective range approximation is considered briefly. J.C.Taylor

539.12

11398. EVIDENCE FOR RESONANCE STATES IN THE K^-—N SYSTEM. P.T.Matthews and A.Salam.
Phys. Rev. Letters, Vol. 2, No. 5, 226-7 (March 1, 1959).

It is suggested that K^-—p scattering data indicate a $J = \frac{1}{2}$ resonance at about $T_K(\text{lab}) = 25$ MeV. Consequences for K^-—p scattering and absorption and for associated production are derived and discussed. J.C.Taylor

539.12

11399. EVIDENCE FROM PHOTOPRODUCTION FOR A PSEUDOSCALAR K^+ MESON. M.J.Moravcsik.
Phys. Rev. Letters, Vol. 2, No. 8, 352-4 (April 15, 1959).

To investigate the K^+—ΛN relative parity, the associated photoproduction angular distribution is extrapolated to a pole at an unphysical angle. The results suggest negative parity. A little improvement in the data would allow a much firmer conclusion.
R.J.N.Phillips

539.12

11400. ASYMMETRY IN THE DECAY OF Σ HYPERONS. R.L.Cool, B.Cork, J.W.Cronin and W.A.Wenzel.
Phys. Rev., Vol. 114, No. 3, 912-20 (May 1, 1959).

A search was made for an asymmetry in the decay of $\Sigma^\pm$ hyperons. The $\Sigma^\pm$ were produced in the reactions $\pi^\pm + p \rightarrow \Sigma^\pm + K^+$. Detection and identification of the K^+ mesons by a counter technique selects the above reactions and establishes the plane of production. Additional counters, which detect the pions from the Σ-hyperon decay in coincidence with the K^+ mesons, measure the symmetry with respect to the plane of production. The results yield the parameter $\alpha\bar{P}$, where α measures the strength of parity nonconservation and $\bar{P}$ is the average polarization of the Σ hyperon. The data give: for Σ^- produced by 1.0 BeV π^-, $\alpha^-\bar{P} = +0.02 \pm 0.05$; for Σ^- from 1.1 BeV π^-, $\alpha^-\bar{P} = -0.06 \pm 0.05$; for Σ^+ from 1.0 BeV π^+, the decay mode $\Sigma^+ \rightarrow \pi^+ + n$ gives $\alpha^+\bar{P} = +0.02 \pm 0.07$ and the mode $\Sigma^+ \rightarrow \pi^0 + p$ gives $\alpha^0\bar{P} = +0.70 \pm 0.30$. The value of $\alpha^0\bar{P}$ for $\Sigma^+ \rightarrow \pi^0 + p$ strongly indicates that parity is not conserved. For the Σ^+, $|\bar{P}| \geq 0.70 \pm 0.30$; thus we can conclude $|\alpha^+| \leq 0.03 \pm 0.11$. The results therefore indicate that the asymmetry parameter α depends upon the isotopic spin states in the final pion-nucleon system. The dependence on the isotopic spin is compatible with the $\Delta I = \pm\frac{1}{2}$ rule.

539.12

11401. INNER BREMSSTRAHLUNG IN HYPERON DECAYS. S.Barshay and R.E.Behrends.
Phys. Rev., Vol. 114, No. 3, 931-5 (May 1, 1959).

The angular distribution, energy spectrum, and total rate for the pion modes of hyperon decay with inner bremsstrahlung are calculated. The contributions from static anomalous magnetic moments are also included. In principle, it is then possible to experimentally determine the one unknown parameter of the problem — the static anomalous magnetic moment of the hyperon.

539.12

11402. POSSIBLE DETERMINATION OF HYPERON PARITIES AND COUPLING STRENGTHS. S.Barshay and S.L.Glashow.
Phys. Rev. Letters, Vol. 2, No. 8, 371-3 (April 15, 1959).

Discusses possible applications of "pology" to the processes $\Sigma^- + p \rightarrow \Lambda + n$ and $\Sigma^- + p \rightarrow \Sigma^0 + n$. R.J.N.Phillips

539.12

11403. POLARIZATION EFFECTS IN Σ^- HYPERONS CAPTURE BY DEUTERONS. O.D.Cheishvili and S.G.Matinyan.
Nuovo Cimento, Vol. 13, No. 1, 108-14 (July 1, 1959).

A phenomenological treatment of polarized Σ^--hyperon capture by deuterons with the production of Λ^0-particles is given. The quantitative investigation shows that the study of polarization correlations of these particles allows one to obtain certain information about the polarization state of a Σ^--particle.

539.12

11404. S-WAVE DETECTOR OF DEUTERON POLARIZATION AND 14 MeV POLARIZED-NEUTRON SOURCE. A.Galonsky, H.B.Willard and T.A.Welton.
Phys. Rev. Letters, Vol. 2, No. 8, 349-51 (April 15, 1959).

It is shown that the $T(d,n)He^4$ reaction can be used as a sensitive detector of the polarization of low energy deuterons. With a polarized deuteron beam, 14 MeV polarized neutrons can also be produced using this reaction. C.J.Batty

NUCLEUS

539.14

11405. ON THE THEORY OF THE SATURATION OF NUCLEAR FORCES. W.Brunner.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 3-4, 137-54 (1959).
In German.

A method is developed for calculating the binding energies of nuclei. The energy is separated into "kinetic" and "potential" parts. The former is calculated in the Fermi gas approximation, corrected for the presence of the hard core in the nuclear force by an interpolation formula due to London. The potential energy is calculated by regarding the nucleons as a system of two coupled fields, a nucleon field and a neutral scalar meson field. The total energy is then minimized with respect to the density. A binding energy per particle of 7 MeV is obtained, at about the correct density. E.J.Squires

539.14

11406. THE SATURATION OF NUCLEAR FORCES. W.Brunner.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 5-6, 233-40 (1959).
In German.

A discussion is given of whether two-body nuclear forces with hard cores give saturation at the correct density, or whether many-body repulsive forces are required, as has been suggested by Macke (Abstr. 9315 of 1957). It is shown that Macke's calculation underestimates the kinetic energy and so gives a density too small by a factor 10. The necessity of repulsive many-body forces is thus removed. E.J.Squires

539.14

11407. SATURATION OF NUCLEAR FORCES .... NEUTRON PROTON SCATTERING. A.B.Bhatia and S.M.Shah.
Progr. theor. Phys., Vol. 17, No. 4, 561-6 (April, 1957).

With the help of a potential so chosen as to satisfy the saturation requirements and the various experimental data on the deuteron, and nucleon–nucleon scattering at low energies, the neutron–proton differential scattering cross section, $\sigma(\theta)$, is calculated at 100 MeV and 260 MeV in the Born approximation. The error due to the use of Born's approximation at 100 MeV is estimated. The calculated cross-sections are in fair agreement with experiment and indicate the desirability of making an exact phase-shift calculation of $\sigma(\theta)$ for this potential.

539.14

11408. APPLICATION OF A SIMPLE VARIATION PRINCIPLE TO THE BINDING ENERGIES OF LIGHT NUCLEI. W.Inthoff.
Ann. Phys. (Leipzig), Folge 7, Vol. 3, No. 3-4, 220-32 (1959).
In German.

Using simple Gaussian potentials, without hard cores, and the Hartree–Fock variational method with harmonic oscillator wave-functions, the binding energies of light nuclei (from H^2 to O^{16}) are calculated. The exchange character of the potential and its depth, and also the strength of the spin orbit interaction, are chosen to give the best agreement with experimental binding energies and radii. The relative strength of the singlet and triplet potentials obtained from this work agrees with that required in low energy scattering. E.J.Squires

539.14

11409. A SIX-DIMENSIONAL INTERPRETATION OF NUCLEAR FORCES. J.Rayski.
Bull. Acad. Polon. Sci. Ser. Sci. math. astron. phys., Vol. 7, No. 4, 251-4 (1959).

The equation for a nucleon coupled to the pion field is rewritten in a six-dimensional form, which gives a geometrical meaning to isospin and electric charge. R.J.N.Phillips

539.14

11410. FINITE-RANGE DELTA-FUNCTION POTENTIAL. M.Bolsterli.
Phys. Rev., Vol. 114, No. 6, 1605-8 (June 15, 1959).

The long-range part of the nucleon–nucleon potential is approximated by the finite-range delta-function potential: $V_{\text{singlet even}} = V_1\delta(r-a)$, $V_{\text{triplet even}} = V_2\delta(r-a) + V_T\,(r-a)S_{12}$. The best fit to the low-energy n–p data is obtained when V_2 is repulsive and V_T is large. The uncertainties in the V's are of the order of 10%.

539.14

11411. PION THEORY OF THREE-BODY FORCES. J.Fujita and H.Miyazawa.
Progr. theor. Phys., Vol. 17, No. 3, 360-5 (March, 1957).

Three-body forces among three nucleons are calculated on the basis of static pion theory. It is assumed that only one pion each is exchanged between nucleon (1) and (2), and between (2) and (3), although any number of pions may be emitted and absorbed by the same nucleon. The validity of this calculation is therefore limited to the case when every nucleon is well separated from the other. This three-body potential has a contribution of about 0.22 MeV to th triton binding. In a heavy nucleus the binding energy due to this potential is attractive and about 10% of that due to two-body interaction. This effect can be roughly stated as follows. Within nuclea matter the potential between two nucleons takes a different shape d to many-body forces. The depth is increased by 9% and the range i decreased by 13%.

539.1

11412. SPIN–ORBIT COUPLING IN HEAVY NUCLEI. J.Fujita and H.Miyazawa.
Progr. theor. Phys., Vol. 17, No. 3, 366-72 (March, 1957).

Using the result of a previous calculation (preceding abstract) a strong spin–orbit coupling, compared with the Thomas term, is derived. Though it is not sufficient to explain the observed spin–orbit coupling itself, a considerable part of the nuclear spin–orbit interaction should be due to the many-body forces.

539.1

11413. ON THE SPHERICAL OSCILLATOR NUCLEUS. T.D.Newton.
Canad. J. Phys., Vol. 37, No. 8, 944-64 (Aug., 1959).

The degree of consistency of an oscillator model of a nucleus i examined by means of a type of Hartree–Fock calculation based or simple form of inter-nucleon potential valid at low energies. An effective mass equal to 0.757 times the mass of a free nucleon is used. The oscillator wave-functions are found to be not far from self-consistent and the oscillator frequency derived is physically reasonable, but the bound on the binding energy is not good. It is also shown that the oscillator wave-functions are a good approxim ation for the state functions of particles bound in a finite potential well having the shape of a cutoff oscillator so that the Hartree–Foc calculation can be used to prescribe a shell model potential.

539.1

11414. ANALYSIS OF A ROTATIONAL STATE IN TERMS OF THI SHELL MODEL STATES. A.Arima and S.Yoshida.
Nuclear Phys., Vol. 12, No. 2, 129-58 (July (1), 1959).

The wave-function of a rotational state is analysed in terms of shell-model wave-functions. The rotational wave-function is constructed in the three-dimensional model for even nuclei accordin to the method of the generator coordinates. For the single-particle potential the deformed harmonic oscillator well is assumed, and th spin–orbit coupling is neglected. The wave-function of the rotation state is expressed in terms of the shell-model wave-functions. The distributions function of the shell-model states of given excitation-energy is found to be of Poisson type. For light nuclei in the lower excited states the rotational wave-function is mainly composed of the degenerate lowest shell-model states, Elliott's wave-functions (1958), while for heavy nuclei or light nuclei in the higher excited states the main contribution comes from shell-model states with e citation energy of a few $\hbar\omega_0$, where ω_0 is the angular frequency of the harmonic oscillator. The matrix element of the quadrupole tra sition is also calculated. Its value, taking only the Elliott states, i found to give half the correct value, while the calculation taking int account both the Elliott states and the interference terms with the states of excitation energy $2\hbar\omega$ is found to give the right answer.

539.1

11415. QUADRUPOLE INTERACTION IN SU_3-COUPLING AND CRANKING MODEL. H.Pilkuhn.
Nuclear Phys., Vol. 12, No. 3, 269-73 (July (2), 1959).

For nuclei possessing stable deformations, the two-particle quadrupole interaction is expressed in terms of a deformed harmonic oscillator potential, and the moments of inertia in the corresponding coupling schemes (SU_3-coupling and cranking model are shown to be the same.

539.14 : 539.1

11416. THE PENETRATION OF THE DIFFUSE NUCLEAR POTENTIAL BARRIER. K.Kikuchi.
Progr. theor. Phys., Vol. 17, No. 5, 643-50 (May, 1957).

The effect of the diffuse nuclear potential on the penetration of the potential barrier is examined using a simplified model. The transmission coefficient for slow neutrons is treated in an exact way employing an exponential diffuse potential and is found to be

rger by a factor 2 than in the usual calculation. The Coulomb enetrability is investigated on the basis of the W.K.B. method, nd the diffuseness makes the penetration factor much larger than iat obtained in the conventional calculation. An application to the vaporation process is developed and the energy spectrum of -particles from the $Al^{27}(n,\alpha)Na^{24}$ reaction is found to be explained y the corrected penetrability in a satisfactory way.

539.14

11417. THE l-FORBIDDEN MAGNETIC DIPOLE TRANSITIONS. A.Arima, H.Horie and M.Sano.
Progr. theor. Phys., Vol. 17, No. 4, 567-80 (April, 1957).

The reduced matrix elements for l-forbidden magnetic dipole ransitions in medium-weight nuclei are calculated on the basis of configuration mixing. The calculations are based upon simple perturbation theory. The parameters used in this calculation are he same as those adopted for the magnetic and quadrupole moments n previous work. The lifetimes of these radiative processes are ell explained by small admixtures of excited configurations with he shell-model configurations.

539.14

1418. POSSIBLE EFFECTS OF NUCLEAR SHELL CLOSURES ON NEUTRON STRENGTH FUNCTIONS.
A.M.Lane, J.E.Lynn, E.Melkonian and E.R.Rae.
Phys. Rev. Letters, Vol. 2, No. 10, 424-5 (May 15, 1959).

Conventional complex potential models do not explain observed strength functions in the region $90 < A < 130$. It is arranged that this may be due to fluctuation in the absorptive part of the potential when N and Z are near the magic number 50. R.J.N.Phillips

539.14

.1419. GENEALOGICAL COEFFICIENTS IN THE GENERALIZED NUCLEAR MODEL. V.G.Neudachin and Yu.F.Smirnov.
Zh. eksper. teor. Fiz., Vol. 36, No. 1, 186-92 (1959). In Russian.

The construction of a wave-function of a system of n nucleons with prescribed values of the isobaric spin T from the wave-functions of individual states N_1, N_2....N_n, not coupled vectorially, is considered. The number of independent states with a given T is determined by algebraic methods. The problem is primarily of interest in relation to the unified model of light nuclei.

539.14

.1420. THE MAGNETIC OCTUPOLE MOMENTS OF NUCLEI.
S.Suekane and Y.Yamaguchi.
Progr. theor. Phys., Vol. 17, No. 3, 443-8 (March, 1957).

The magnetic octupole moment Ω of the nucleus is discussed on the basis of the shell and collective models. In the strong coupling case of the collective model, Ω becomes smaller than the shell-model result because of the quenching of the moment along the symmetry axis of the deformed core. This fact is in agreement with available experimental data ($Ga^{71,73}$, In^{115}, and I^{127}).

539.14

11421. THE HEXADECAPOLE MOMENTS OF ATOMIC NUCLEI.
S.Suekane and Y.Yamaguchi.
Progr. theor. Phys., Vol. 17, No. 3, 449-60 (March, 1957).

The electric hexadecapole moments $Q^{(4)}$ of atomic nuclei are investigated on the basis of three nuclear models, i.e. shell, liquid drop, and collective models. The effect of the deformed core on this higher moment is discussed in detail. It is shown that experimental values of $Q^{(4)}$ can be used to test the validity of the collective model (Bohr–Mottelson's theory), and the core part of $Q^{(4)}$ can be used to derive information about the core deformation of order 4.

539.14

11422. EFFECT OF NUCLEAR ELECTRIC DIPOLE MOMENTS ON NUCLEAR SPIN RELAXATION IN GASES.
P.A.Franken and H.S.Boyne.
Phys. Rev. Letters, Vol. 2, No. 10, 422-3 (May 15, 1959).

It is shown that upper limits can be set to nuclear electric dipole moments from a knowledge of the nuclear spin relaxation times of pure gases at high pressures. From existing data for He^3 and Xe^{129} it is concluded that the nuclear electric dipole moments are not greater than 0.06 μ_N and 0.04 μ_N, respectively, where μ_N is the nuclear magneton in Gaussian units. E.F.W.Seymour

539.14

11423. DEFORMATION AND QUADRUPOLE MOMENTS OF LIGHT NUCLEI. E.Windthorst.
Z. Naturforsch., Vol. 14a, No. 3, 294-305 (March, 1959). In German.

The quadrupole moments of Li^6, Li^7, Be^9 and N^{14} are calculated using a deformed oscillator potential and taking into account the nucleon–nucleon interactions and configuration mixing. The deformation is obtained by minimizing the energy. The results show reasonable agreement with experimental values. E.J.Squires

539.14

11424. QUADRUPOLE OSCILLATIONS OF DEFORMED NUCLEI.
B.L.Birbrair, L.K.Peker and L.A.Sliv.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 803-9 (1959). In Russian.

Formulae are derived for quadrupole oscillations of deformed nuclei. The interaction between the rotation and vibrations is considered and a general formula is given for the corrections to the level energy of the ground rotational band. Presently available experimental data for nuclei in the rare earth region are discussed and the difficulties encountered in their analysis are mentioned.

539.14

11425. ON THE DEFORMABILITY OF THE NUCLEAR CORE.
Z.Szymański.
Bull. Acad. Polon. Sci. math. astron. phys., Vol. 7, No. 4, 233-6 (1959).

The deformation parameter of a closed-shell plus-one nucleus is calculated for a spheroidal square-well potential. The value of the parameter is several times larger than that found for a harmonic oscillator potential. The experimental value for heavy nuclei is intermediate between the harmonic oscillator and square-well values. E.J.Squires

539.14

11426. ON THE AXIAL STABILITY OF A DEFORMED NUCLEUS. I.
P.N.Mukherjee and I.Dutt.
Indian J. Phys., Vol. 32, No. 4, 165-73 (April, 1958).

The energy eigenvalues of a single particle moving in an anisotropic harmonic oscillator potential have been calculated assuming that the equipotential surface coincides with the nuclear surface. It has been found that in the rare-earth region the shell-model energy levels of a single particle depend sensitively on the deviation of the nuclear shape from cylindrical symmetry. Calculations up to the Ca^{40} core show that the energetically stable form of the nucleus corresponds to either $\gamma = 0$ or $2\pi/3$. It is also found that the total energy of an oblate nucleus is about 2 MeV greater than that of a prolate one, which is consistent with the observed positive excess of quadrupole moment in the rare-earth region.

539.14 : 538.27

11427. DYNAMIC NUCLEAR POLARIZATION.
M.Abraham, M.A.H.McCausland and F.N.H.Robinson.
Phys. Rev. Letters, Vol. 2, No. 11, 449-51 (June 1, 1959).

Enhanced and reversed polarization of host nuclei has been observed on saturation of partially forbidden electron paramagnetic resonance transitions of impurities in several materials. The paramagnetic impurities were of a variety of types. E.F.W.Seymour

539.14 : 539.12

THE ELECTRICAL POLARIZABILITY OF THE MESON CLOUD IN THE NUCLEON. See Abstr. 11362

539.14

11428. ON THE POSSIBLE EXISTENCE OF A ZERO-SPIN EXCITED STATE IN Ca^{42}. I.Asplund and T.Wiedling.
Ark. Fys., Vol. 15, Paper 26, 303-6 (1959).

The 0.3 - 1.5 MeV gamma cascade in Ca^{42} was investigated by angular correlation measurements. It has been shown that the second excited level is probably a 0+ spin state and that the 0.3 MeV transition has E2 character.

539.14

11429. THE OCCURRENCE OF A SUPERCONDUCTING STATE OF AN ATOMIC NUCLEUS. V.G.Solov'ev.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 4, 652-4 (Dec. 1, 1958). In Russian.

Weak interactions between nucleons in the same shell of an atomic nucleus are considered. It is shown that the only interactions important in the discussion of a superconducting state are those between nucleons whose momentum coordinates along the axis of symmetry of the nucleus are equal and opposite. An expression for the energy gap is calculated. The occurrence of a superconducting state is suggested to explain the energy gap between the ground state and the first single-particle excited states in heavy even-even nuclei. M.G.Priestley

539.14

11430. SYSTEMS OF LEVELS IN EVEN–EVEN NUCLEI. C.A.Mallmann.
Phys. Rev. Letters, Vol. 2, No. 12, 507-9 (June 15, 1959).

It is shown that if for even–even nuclei the ratio of the energy of the first excited 6+ and 8+ states to the energy of the first excited 2+ state is plotted against the ratio of the first excited 4+ state to the energy of the first excited 2+ state practically all the known points lie on two curves, one for the 6+ states and one for the 8+ states. L.L.Green

539.14 : 539.166

LEVEL SCHEME OF Ba^{136}. See Abstr. 10081

539.14 : 539.166

STUDY OF Ho^{165}. See Abstr. 10078

539.14

11431. SURVEY OF THE HYPERFRAGMENT EXPERIMENTAL DATA. A.Filipkowski, J.Gierula and P.Zieliński.
Acta phys. Polon., Vol. 16, No. 1-2, 139-50 (1957).

From about 120 events interpreted as hyperfragment decays, 72 were selected as being definitely hyperfragment decays. The production, decay, binding energy, structure, and life-time of light hyperfragments were studied from this sample. Tables facilitating the estimation of the binding energy of the Λ^0 hyperon in light hyperfragments are given.

539.14

11432. A SYSTEMATIC STUDY OF HYPERFRAGMENTS PRODUCED BY 4.5 GeV π^- IN NUCLEAR EMULSION. I. π^--MESIC DECAYS. W.E.Slater.
Nuovo Cimento Suppl., Vol. 10, No. 1, 1-40 (1958).

The analysis of 43 mesic decays of hyperfragments is presented in detail with values of the Λ-particle binding energies for $^4H_\Lambda$ (1.38 ± 0.30), $^4He_\Lambda$ (1.84 ± 0.27), $^5He_\Lambda$ (2.97 ± 0.17), $^7Li_\Lambda$ (4.43 ± 0.64), $^8Li_\Lambda$ (5.42 ± 0.84), $^8Be_\Lambda$ (6.25 ± 0.37), and $^9Be_\Lambda$ (6.32 ± 0.42). Photomicrographs of typical events are given. The $^8Li_\Lambda$ and $^8Be_\Lambda$ mesic decays are reported for the first time. E.J.Burge

539.14

11433. A SYSTEMATIC STUDY OF HYPERFRAGMENTS PRODUCED BY 4.5 GeV π^- IN NUCLEAR EMULSION. II. NON-MESIC DECAYS. E.M.Silverstein.
Nuovo Cimento Suppl., Vol. 10, No. 1, 41-67 (1958).

216 "possible" and 56 "definite" hyperfragments were analysed using an I.B.M. 650 computer. Each event required at least one neutral particle to balance the residual momentum, thereby introducing considerable uncertainties. The total number of non-mesic hyperfragments was estimated to be 185 ± 40, or 5.0 ± 1.3 times the corresponding number of mesic decays, and giving a total absolute yield of $(1.8 \pm 0.3) \times 10^{-3}$ hyperfragments per primary star. Possible modes of decay are studied, assuming that only one neutral particle is emitted. The non-mesic to mesic ratio as a function of Z is in very good agreement with the theoretical values of the spin of the Λ is taken as $\frac{1}{2}$. Hyperfragment mechanisms are discussed. E.J.Burge

RADIOACTIVITY

539.16.08 : 539.1.07

11434. ESTIMATION OF C^{14} IN THE GAS PHASE IN A GEIGER–MÜLLER COUNTER FILLED WITH A MIXTURE OF CO_2 OR CO AND A HEAVY SATURATED HYDROCARBON.
I.Złotowski and M.Zieliński.
Nukleonika, Vol. 3, No. 5, 529-46 (1958). In Polish.

A method was studied of measurement of radiocarbon as $^*CO_2$ and as $^*CO$ in Geiger-Müller counters filled with a mixture of these gaseous radioactive carbon compounds and a small quantity of saturated hydrocarbon vapours, such as n. hexane, n. heptane, n. octane, cyclohexane. It was proved that counters filled with vapour of saturated hydrocarbons, pure or mixed with carbon monoxide or carbon dioxide are self-quenched counters and have good characteristic curves. The characteristic curves were studied of the G.M. counters filled with the different mixtures of CO, CO_2 and saturated hydrocarbons as a function of the nature of the hydrocarbons, of the total gas pressure in a counter and of the partial pressure of components of gas-filling of the counter. The preliminary experiment showed that the partial pressure of carbon oxide cannot exceed the partial pressure of quenching-hydrocarbon intoduced to the counter. Setting up a resistance of the order of 100 MΩ between the anode wire of the counter and its supply of potential one received a resolving time of the order of $3 - 6 \times 10^{-4}$ sec., the plateau region from 200 up to 600 V with the slope less than 3% per 100 V at the counting rates of the order of few thousand counts per minute. Stability and reproducibility of the characteristic curves, as well as reproducibility of the measured specific activity were very satisfactory. With the statistical errors the measured activity was proportional to the partial pressure of "marked" gaseous radioactive substances ($^*CO_2$ or $^*CO$) in the counter gas-filling.

539.163

11435. DECAY OF Co^{56} AND Mn^{56}. P.Kienle and R.E.Segel.
Phys. Rev., Vol. 114, No. 6, 1554-60 (June 15, 1959).

Scintillation spectroscopy and coincidence techniques were used to measure the decay schemes of Mn^{56} and Co^{56}, both of which decay to Fe^{56}. Gamma-ray energies and intensities were measured with the aid of a large NaI(Tl) crystal and a three-crystal pair spectrometer. Combining these data with γ–γ and β–γ coincidence measurements, decay schemes are constructed for both nuclei. The log ft values for the various β branches are examined and all of the β branches from Co^{56} show higher than usual log ft values for allowed transitions. The Co^{56} decay to the second excited state in Fe^{56} is inhibited by a factor of ~ 10^3 while the Mn^{56} decay to the same state is inhibited even further. The allowed Mn^{56} decay to the first excited state in Fe^{56} is also slowed, while Mn^{56} decays to higher states proceed at more normal speeds. A discussion of the β-transition rates in terms of shell model assignments is given, from which some explanation of the β rates results. The high inhibitions of the decays to the second excited state in Fe^{56} do not seem susceptible to a simple shell-model explanation.

539.163

11436. DECAY OF Zn^{61}. J.B.Cumming.
Phys. Rev., Vol. 114, No. 6, 1600-4 (June 15, 1959).

The 88.5 sec activity observed among the products of the bombardment of nickel with 16 MeV alpha particles is assigned to Zn^{61}. The decay properties of this isotope were investigated by beta and gamma scintillation techniques and by coincidence measurements. Approximately 80% of the Zn^{61} beta decays are to the ground state of Cu^{61}. The positron end point is 4.38 MeV which corresponds to a log ft of 5.2 and to an allowed transition. Gamma rays of 0.48, 0.98, and 1.64 MeV have been observed with intensities of 11.2, 2.9, and 6.2% of the positrons. There is some indication of gamma-rays at 0.69 MeV and possibly other energies in lower intensities. A decay scheme is proposed which incorporates the above data into an existing level scheme of Cu^{61} derived from (p,γ) experiments.

539.163

11437. NATURAL RADIOACTIVITY OF GADOLINIUM 152 AND HAFNIUM 174. W.Riezler and G.Kauw.
Z. Naturforsch., Vol. 14a, No. 2, 196 (Feb., 1959). In German.

Values of the decay constant of 7.3×10^{-16} years and $1.6 \times \times 10^{-16}$ years and the alpha-particle energies of 1.7 and 2.5 MeV for the two elements respectively. J.M.Hough

539.163

11438. DETERMINATION OF THE LIFETIME OF THE FIRST EXCITED STATE OF THE Be^{10} NUCLEUS.
A.N.Boyarkina and A.F.Tulinov.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 353-61 (1959). In Russian.

The theory of the method, based on the application of recoil nuclei, is presented. An experiment is described in which the lifetime τ of the Be^{10} nucleus in the 3.37 MeV excited state was measured. An upper limit for τ is obtained, $\tau < 8 \times 10^{-14}$ sec.

539.163

11439. ON THE QUESTION OF COLLECTIVE EFFECTS IN LIGHT NUCLEI. V.V.Balashov and A.F.Tulinov.
Zh. eksper. teor. Fiz., Vol. 36, No. 2, 615-16 (Feb., 1959). In Russian.

With reference to E2 transitions in light nuclei, some general considerations are presented which are independent of the exact mechanism by which collective effects enhance the quadrupole transition probability. P.K.Kabir

539.163 : 539.17

NUCLEAR SPECTROSCOPY OF ODD-MASS (161-173) UCLIDES PRODUCED BY PROTON IRRADIATION OF Er AND b. See Abstr. 10109

539.163 : 551.513

COSMIC RAY PRODUCED RADIOISOTOPES FOR STUDYING HE GENERAL CIRCULATION IN THE ATMOSPHERE. See bstr. 10420

539.164 : 539.1.07

$Li^8 \rightarrow Be^{8*}$ DECAY. ANGULAR DISTRIBUTION OF THE -PARTICLES. See Abstr. 11306

539.165

1440. MEASUREMENTS ON THE RADIATIONS FROM THE ECAY OF I^{134} AND I^{133}. G.Holm and H.Ryde. rk. Fys., Vol. 15, Paper 30, 387-96 (1959).

The beta and gamma radiations were studied by means of nagnetic beta-spectrometers and scintillation techniques. A Fermi nalysis of the beta-ray spectrum from the decay of I^{134} shows that t is very complex. The maximum energy is found to be 2.35 MeV nd the measured energies of two further components are 1.57 and .3 MeV. The energies of the gamma rays following the decay of ^{134} are 0.138, 0.21, 0.42, 0.63, 0.86 (there seem to be two gamma ays with about this energy), 1.07, 1.14, 1.45, 1.62 and 1.80 MeV. Coincidence experiments have been carried out and the beta disinteration energy (Q_{β^-} value) for the decay of I^{134} to Xe^{134} is estimated as 4.1 MeV. As regards the decay of I^{133}, the maximum energy of he beta-ray spectrum is found to be 1.27 MeV. Furthermore, beta omponents are found having energies of about 0.94 and 0.7 MeV. Gamma rays with the following energies are associated with this decay: 0.35, 0.53, 0.71, 0.87, 1.05, 1.24 and 1.30 MeV.

539.165

11441. BETA AND GAMMA RAY SPECTROSCOPY OF Co^{60}. K.Kamada, T.Teranishi and Y.Yoshizawa. J Phys. Soc. Japan, Vol. 13, No. 7, 763-4 (July, 1958).

The following results of measurements are tabulated: the maximum energy of β-rays, the K-shell and total-conversion coefficients and the K/(L + M) ratios of the 1.17 and 1.33 MeV γ-rays. The Curie plot of β-rays and the momentum distribution of the internal-conversion electrons of 1.17 MeV γ-transition are shown in the form of graphs. It was found that, whereas the experimental values of α_K for both γ-rays agree with the theoretical values, this is not true of the K/(L + M) values; a tentative explanation of the latter discrepancy is given. F.Lachman

539.165

11442. A STUDY OF THE β-SPECTRUM OF Tl^{204}. F.Grard. Physica, Vol. 24, No. 11, 868-74 (Nov., 1958). In French.

The β-ray spectrum was investigated down to 50 keV energy, using a double focusing spectrometer. It is found to correspond to a simple, first forbidden "unique" transition of energy 760 ± 10 keV. No gamma-ray corresponding to a previously suggested lower energy β-transition was found, and it is pointed out that the evidence for such a transition obtained from earlier work on the β-spectrum shape, could have arisen from parasitic effects of the type encountered and eliminated by the author. A.E.I. Research Laboratory

539.165

11443. CALCULATION OF THE CORRECTIONS FOR THE ANALYSIS OF THE β-SPECTRA AND THEIR APPLICATION TO Ho^{166}. G.Alaga and B.Jakšić. Period. math.-phys. astron. (Zagreb), Vol. 12, No. 1-2, 31-74 (1957).

It is shown that the large log ft (= 8.1) value and approximately allowed shape of the 0^- to 0^+ ground state transition in the decay of Ho^{166} to Er^{166} may be qualitatively explained by a tensor pseudoscalar mixture, although the amount of pseudoscalar admixture cannot be determined without new experimental data or calculation of the matrix elements involved. The case of destructive interference of pseudoscalar and tensor coupling was investigated. Here, the pseudoscalar is dominant, and corrections have been calculated for finite nuclear size and wavelength. A secon possibility considered is that of a singular tensor matrix element, where the main correction is the variation of the lepton fields over the nuclear region. A.E.I. Research Laboratory

539.165

11444. MONOENERGETIC POSITRONS IN THE DECAY OF Bi^{206}. J.H.Brunner, H.J.Leisi, C.F.Perdrisat and P.Scherrer. Phys. Rev. Letters, Vol. 2, No. 5, 207-9 (March 1, 1959).

After K-capture and subsequent γ-emission of sufficient energy, a competing process to internal pair formation is possible, whereby the electron of the pair is captured by the K-shell vacancy and the positron emitted with a definite energy, equal to the γ-energy plus the K-electron binding energy, minus the rest mass energy of the pair. This process, predicted by Sliv (Abstr. 486, 9898 of 1955), is shown to occur in the electron capture decay of Bi^{206} to the 3.403 MeV level of Pb^{206}, by the discovery of positrons with the calculated discrete energy of intensity 2.61×10^{-7} positrons per γ-quantum. A mean lifetime of the Pb^{206} 3.403 MeV level has been calculated to be 1.8×10^{-15} sec. A.E.I. Research Laboratory

539.165

11445. THE β—γ CIRCULAR POLARIZATION CORRELATION OF Sc^{46}. W.Jüngst and H.Schopper. Z. Naturforsch., Vol. 13a, No. 7, 505-7 (July, 1958). In German.

Measured the mixed β-transition as a function of electron energy. An asymmetry coefficient A = +0.24 ± 0.04 was found, which is somewhat lower than that given by other authors. Thus no conclusion about time reversal invariance can be drawn. However, the ratio of matrix elements and their relative phase was determined.

539.165

11446. CONCLUSIONS FROM THE TWO-COMPONENT ELECTRON CHARACTER IN β-INTERACTIONS. B.L.Ioffe and V.A.Lyubimov. Zh. eksper. teor. Fiz., Vol. 34, No. 5, 1321-3 (May, 1958). In Russian. English summary: PB 141052T-2, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

A discussion of the experiments needed to determine this interaction, assuming the form

$$H = \sum_{\alpha} C_\alpha (\bar{\Psi}_p O_\alpha \Psi_n)\, \bar{\Psi}_e (1 - \gamma_5) O_\alpha \Psi_\nu + \text{complex conjugate.}$$

R.J.N.Phillips

539.165

11447. ANGULAR β—γ CORRELATION IN THE DECAY OF Ba^{139} AND THE SIGN OF THE RATIO OF THE β-INTERACTION CONSTANTS. N.A.Vlasov and V.P.Rudakov. Zh. eksper. teor. Fiz., Vol. 36, No. 1, 24-7 (1959). In Russian.

The differential angular correlation was measured for the cascade E_β = 2.23 MeV and E_γ = 0.163 MeV. The anisotropy coefficient for total β-particle energies of 4 mc^2 was found to equal a = +0.058 ± 0.023. The result is compared with that obtained by calculations performed on basis of the single-particle model. The theoretical result agrees with experiment only for negative values of the ratio g_V/g_A.

539.165

11448. NEUTRINO RECOIL EXPERIMENT ON Li^8. K.H.Lauterjung, B.Schimmer, U.Schmidt-Rohr and H.Maier-Leibnitz. Z. phys., Vol. 155, No. 5, 547-59 (1959). In German.

The beta-decay of $Li^8 \rightarrow Be^{8*} \rightarrow 2\alpha$ is especially suitable in neutrino recoil experiments on account of the large beta-decay energy available and of the subsequent break up of Be^{8*} into two α-particles. For the angular correlation between the antineutrino and the α-particle, one obtains, for the present counter geometry and a Gamow—Teller interaction, the angular distribution

$$w(\nu)d\nu = \left(1 + b\frac{v}{c} 0.707 \cos\nu\right) d\nu,$$

where b = −1 for axial vector interaction (A) or b = +1 for tensor interaction (T) and where ν is the angle between the direction of emission of the antineutrino and the α-particle. The measurement of the energy difference of the two α-particles in the Be^{8*} decay, when the direction of the emission of the beta-particle is fixed, defines the angular correlation coefficient b. In this experiment the value of b is found to be equal to −1.12 ± 0.20, which shows axial vector interaction in the Gamow—Teller decay.

539.165

11449. ELECTRON POLARIZATION IN THE $0^- \rightarrow 0^+$ BETA-DECAY OF Ho^{166}. W.Bühring. Z. Phys., Vol. 155, No. 5, 566-79 (1959). In German.

The polarization P of the beta-rays from Ho^{166} and P^{32} was investigated using the method of combined multiple- and Mott-scattering. The result for $P(v/c)^{-1}$ averaged over the energy range accepted by the apparatus used ($v/c \cong 0.8$) is:

$$\left[\left(-P/\frac{v}{c}\right)_{Ho^{166}}\right]_{Av_e} = (0.99 \pm 0.02) \left[\left(-P/\frac{v}{c}\right)_{P^{32}}\right]_{Av}$$

It is shown that only a small deviation of the polarization from the normal value $-P(v/c)^{-1} = 1$ is to be expected for P^{32} electrons.

Electron polarization and spectrum shape of the $0^- \rightarrow 0^+$-transition of Ho^{166} are discussed with respect to the contribution of pseudoscalar coupling. On the basis of the two-component theory of the neutrino ($C_V = C'_V$, $C_A = C'_A$, $C_P = C'_P$) one obtains an upper limit on the contribution of P-coupling:

$$(C_P^2/C_A^2)\left|\int \beta\gamma_5\right|^2 < \sim 3 \times 10^{-7}.$$

If one does not assume the validity of the two-component theory of the neutrino, however, the experiments are compatible with an arbitrary amount of P-coupling. In this case the experimental result indicates that the two-component theory of the electron ($C_V = C'_V$, $C_A = C'_A$, $C_P = -C'_P$) is valid. A compilation is presented of formulae which are needed for electron polarization calculations using tabulated functions.

539.165

11450. MEASUREMENT OF THE CORRELATION BETWEEN BETA- AND CIRCULARLY POLARIZED GAMMA-RAYS IN CONNECTION WITH PARITY VIOLATION. H.Appel.
Z. Phys., Vol. 155, No. 5, 580-94 (1959). In German.

Parity violation in beta decay was investigated by measuring the $(\beta-\gamma)$ circular polarization correlation. The asymmetry coefficients were redetermined with higher accuracy for Co^{60} ($A = -0.33 \pm 0.01$) and Na^{22} ($A = +0.36 \pm 0.08$). The cos Θ-dependence of the polarization P was verified for the allowed beta transition of Co^{60}. Measurements on Zr^{95} indicated a large GT–F mixture and allowed to determine the relative magnitude of the matrix elements. For the first-forbidden 2.3 MeV transition of Sb^{124} the results are in agreement with the assumption of an anomalously large value of the matrix element B_{ij} compared with all other nuclear matrix elements.

539.165

11451. THE STANDARDIZATION OF ELECTRON-CAPTURE ISOTOPES. R.A.Allen.
Internat. J. appl. Radiation and Isotopes, Vol. 1, No. 4, 289-98 (Jan., 1957).

A method of standardizing orbital electron-capture isotopes is described. The method consists of measuring the efficiency of a 4π proportional counter for the characteristic K X-rays by constructing a curve relating K X-ray count rate and the inverse of the pressure of the counting gas. From knowledge of the K/L capture ratio and K-fluorescence yield, the disintegration rate is deduced. Examples are given and the results are compared with measurement by other techniques.

539.165

11452. L TO K ELECTRON CAPTURE RATIO IN Ge^{71}.
D.E.Renfuss and B.Crasemann.
Phys. Rev., Vol. 114, No. 6, 1609-11 (June 15, 1959).

By comparison of the number of 0.175 MeV gamma-rays occurring in the decay as As^{71} with the number of gallium K X-rays proceeding from Ge^{71} K capture, the relative amount of L capture in Ge^{71} was determined indirectly. Solid sources and a scintillation spectrometer were employed. The Ge^{71} L/K electron capture ratio is found to be 0.09 ± 0.05, in agreement with theory.

539.166

11453. A THEORETICAL STUDY OF THE INTERNAL CONVERSION WITH SPECIAL APPLICATION TO MAGNETIC DIPOLE TRANSITIONS. O.M.Olsson and S.Hultberg.
Ark. Fys., Vol. 15, Paper 29, 361-86 (1959).

The internal conversion process is analysed by taking advantage of the simplifications in the mathematical formalism which are possible near the conversion threshold. The results are applied to M1 conversion in the K-shell. Corrections for various nuclear charge distributions can be easily made and a general insight into the nature of the problem can be obtained, allowing such predictions as the maximum deviation possible from the so-called normal values for the internal conversion coefficients that were first computed by Sliv and Band (1956 and 1958).

539.166

11454. $0^+ \rightarrow 0^+$-TRANSITION IN Ce^{140}.
B.S.Dzhelepov, A.P.Prikhodtseva and Yu.V.Khol'nov.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 6, 995-7 (Aug., 1958).
In Russian.

It is found that there are less than 4×10^{-4} γ-quanta of energy in the region ~ 1900 keV, emitted in the decay of each La^{140} nucleus. Taken together with the 1909 keV conversion electrons found earlier (Abstr. 8926 of 1951), this implies that the corresponding transition in Ce^{140} is $0^+ \rightarrow 0^+$. Internal conversion coefficients for other transitions in Ce^{140} are also presented. P.K.Kabir

539.16

11455. THE INTENSITY OF GAMMA RADIATION EMITTED BY A CYLINDRICAL SOURCE. E.E.Kovalev.
Internat. J. appl. Radiation and Isotopes, Vol. 3, No. 2, 113-18 (195

The intensity of γ-radiation emitted by a cylindrical source is calculated both with and without allowance for self-absorption. An analytical expression involving only tabulated functions is obtained for the radiation yield from a non-absorbing cylinder in the radial direction. It may be applied to sources having appreciable self-absorption by the inclusion of a factor calculated in the second part of the paper. This self-absorption factor is tabulated for various absorption coefficients and for cylindrical sources of different height/diameter ratio.

539.16

11456. INTERNAL CONVERSION IN Li^7. R.D.Leamer.
Phys. Rev., Vol. 114, No. 6, 1590-4 (June 15, 1959).

Upper and lower limits were placed on the internal conversion coefficient of the 479 keV excited state of Li^7. The limits are 16.6×10^{-7} and 5.8×10^{-7}, yielding a multipole mixture of (100% to 55%) M1 and (0% to 45%) E2 for the gamma ray. Photoelectron emission from the source and the background counting rate impose the principal limitations on the accuracy of the experiment.

539.16

11457. LOW INTENSITY TRANSITIONS IN THE DECAY OF RaC, RaC'' AND ThC''. H.Daniel.
Z. Naturforsch., Vol. 12a, No. 3, 194-200 (1957). In German.

An anthracene scintillation counter with single-channel pulse height selection was used as a low-background detector in a magnetic-lens β-ray spectrometer. By analysing the spectrum of the Compton electrons ejected from a thick converter three new γ-rays in the decay RaC → RaC' were found: 2.72 ± 0.02 MeV, 2.89 ± 0.05 MeV and 3.03 ± 0.03 MeV with intensities of 0.026, 0.005, and 0.013, respectively, setting the intensity of the 2.204 Me γ-ray equal to unity. β-ray groups, if existing, from RaC'' to RaD-levels ≤ 1.07 MeV have an intensity $< 5 \times 10^{-3}$ per RaC'' decay. The upper limit for the intensity of a 3.20 MeV cross-over γ-ray in the decay ThC'' → ThD was measured to 1.5×10^{-4} per ThC'' decay.

539.16

11458. CONCERNING THE γ-SPECTRUM OF RaC' (Po^{214}).
C.Mayer-Böricke.
Z. Naturforsch., Vol. 14a, No. 7, 609-27 (July, 1959). In German.

A detailed analysis of the γ-spectrum above 1.1 MeV is presented. In addition to confirming all the known lines with energies exceeding 1150 keV, the presence of a number of weaker γ-transitions of rather higher energy is indicated. A total of 40 lines abov 1 MeV is observed, several of which appear to have a more comple structure. An analysis of the conversion electron spectrum of RaC is made based on measured γ-transitions. A term-scheme is give incorporating all known γ-transitions of RaC', and spin and parity assignments of individual levels are discussed. Some of the levels are interpreted as states of collective vibrations, namely, in terms of one- and two-phonon excitations of a quadrupole motion. The scint lation pair spectrometer with a wedge analyser is discussed fully, together with the electronic equipment used. S.J.St-Lora

539.1

11459. γ-RAYS FROM As^{74}. Yu.E.Loginov and K.I.Yakovlev.
Zh. eksper. teor. Fiz., Vol. 36, No. 3, 940 (March, 1959).
In Russian.

The existence of γ-rays of 1190 and 2200 keV seems establish Two others, 960 and 1600 keV, need confirmation. [Horen and Wel Bulletin of the American Physical Society, Series II, Vol. 5, 315 (1958)]. J.Lasco

539.166 : 539.1

11460. PRECISION DETERMINATION OF ENERGIES OF GAMMA RAYS IN Sm^{152}, $Gd^{152,154,155,156}$, Yb^{170}, AND Os^{188}.
E.N.Hatch and F.Boehm.
Z. Phys., Vol. 155, No. 5, 609-13 (1959).

With the help of the bent-crystal gamma-ray diffraction spectrometer, the energies of 13 gamma rays, most of them belong ing to rotational levels, have been determined with high precision. Rotational parameters are presented for Sm^{152} and $Gd^{154,156}$. A complete level scheme is given for Gd^{155}.

NUCLEAR REACTIONS

539.17

1461. NUCLEAR TRANSFER REACTIONS. I.
M.Demeur and A.Gribaumont.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 44, No. 5, 472-82 (1958).
In French.

A semi-classical description of nucleon transfer reactions is proposed. The wave-function of the odd nucleon is established by means of the eigenfunctions of a two-minima potential. Variational trial functions for such problems are examined. The method is exemplified with the help of a particular potential.

539.17

1462. ON THE ELASTIC SCATTERING OF CHARGED PARTICLES BY NUCLEI IN THE INTERMEDIATE ENERGY REGION.
A.N.Ghoshal and B.B.Baliga.
Progr. theor. Phys., Vol. 17, No. 4, 553-60 (April, 1957).

An expression has been obtained for the differential cross-section for the elastic scattering of intermediate-energy charged particles by heavy nuclei, using a complex potential and employing the variational method due to Montroll and Greenberg. The potential considered is of the type $V = -(V_0 + iW_0)$ inside the nucleus and Ze^2/r outside. The expression obtained for the differential elastic-scattering cross-section has been used in the case of scattering of 32 MeV protons from gold. These have been compared with the experimentally determined cross-sections. It is also shown that the present method of calculation gives results which are in good agreement with those obtained by using the partial-wave method.

539.17

1463. NEUTRON POLARIZATION AND ANGULAR DISTRIBUTIONS IN (p,n) REACTIONS AND NUCLEAR OPTICAL MODEL. J.Sawicki.
Acta phys. Polon., Vol. 16, No. 1-2, 93-117 (1957).
APPENDIX IV TO THE PAPER BY J.SAWICKI. J.Sawicki.
Ibid, Vol. 16, No. 3, 235-6 (1957).

These are calculated, assuming a direct reaction mechanism. The cloudy crystal ball potential modified by a spin–orbit coupling is assumed for the neutron–nucleus interaction. The Coulomb effect of the incident protons results in a flattening of the angular distributions and gives smaller absolute values for the polarization. The model is applied to the reaction $Si^{29}(p,n)P^{29}$ for $E_p = 6$ and 6.5 MeV. The maximum negative polarization (about −65%) appears for the c.m. scattering angle $\theta \sim 100^0$. Further extensions of the model are discussed.

539.17

1464. THE MECHANISM OF THE DIRECT INTERACTION PROCESS AT INTERMEDIATE ENERGIES.
R.J.Griffiths and R.M.Eisberg.
Nuclear Phys., Vol. 12, No. 3, 225-36 (July (2), 1959).

At intermediate energies, most inelastic proton scattering reactions are due to non-compound nucleus processes which are called direct interactions. Several mechanisms for direct interactions have been suggested: (a) nucleon—nucleon collisions in the diffuse surface of the nucleus, (b) nucleon—nucleon collisions occurring throughout the nucleus, (c) direct excitation of low-lying rotational states. Each of these appears to be capable of explaining the experimental data currently available (the energy and angular distribution of single inelastically scattered protons). To obtain additional data for the purpose of distinguishing between these mechanisms, measurements were made of the angular correlation of pairs of protons emitted in direct interactions. Using large solid angle plastic scintillation counters, and coincidence resolving times of ten millimicroseconds, measurements were made on the angular correlation in the range of separation angles 40^0 to 105^0. The energy of the bombarding protons was 40 MeV and Cu, Ni and Pb were used as targets. The results of the experiment indicate that mechanism (a) is predominant at these energies, and that the momentum of the struck nucleon is significantly lower than has been observed in experiments which measure the momentum distribution of nucleons which may be located anywhere within the nucleus.

539.17 : 539.14

11465. MOMENTUM DISTRIBUTION OF NUCLEONS IN THE NUCLEAR SURFACE.
J.E.McCarthy, E.V.Jezak and A.J.Kromminga.
Nuclear Phys., Vol. 12, No. 3, 274-90 (July (2), 1959).

The results of the 40 MeV (p,2p) experiments of Griffiths and Eisberg (see preceding abstract) are analysed on the basis of a model for the total momentum transfer. Assuming two-body collisions and the impulse approximation and representing the momentum distribution of bound protons by a Fermi distribution whose maximum momentum is p_f, it is almost certain that $0.5 \text{ MeV} < p_f^2/2m < 1.5 \text{ MeV}$. Assuming a semiclassical model for the reaction it is shown that the events observed in this experiment occur in the extreme nuclear surface. Thus the experiment is strong evidence in support of the Thomas—Fermi approximation for nucleons in a finite nucleus. Representing the main bulk of the nucleus by an absorbing sphere, it is shown that the observed ratio of (p,2p) to (p,p') events is consistent with the assumption that direct interactions all proceed from an initial two-body collision.

539.17

11466. PROTON TOTAL REACTION CROSS SECTIONS AT 34 MeV. T.J.Gooding.
Nuclear Phys., Vol. 12, No. 3, 241-8 (July (2), 1959).

Measured for C, Al, Fe, Sn and Pb at 34 ± 2.5 MeV. Attenuation measurements were made with a dE/dx telescope and a biased E-counter, in poor geometry. Corrections for elastic and inelastic scattering were determined experimentally. The results have been compared with optical model analysis to select sets of parameters fitting the elastic scattering angular distributions equally well. For carbon the measurements favour the solution with the smaller radius constant. For the other elements the optical model predictions are in good overall agreement but further analysis is required.

539.17

11467. CROSS SECTIONS FOR ELASTIC SCATTERING AND REACTIONS DUE TO PROTONS ON N^{15}.
S.Bashkin, R.R.Carlson and R.A.Douglas.
Phys. Rev., Vol. 114, No. 6, 1543-51 (June 15, 1959).

Absolute differential cross-sections were measured for the reactions $N^{15}(p,p)N^{15}$, $N^{15}(p,\alpha_0)C^{12}$ (ground state), and $N^{15}(p,\alpha_1)C^{12*}$ (first excited state). Thin gas targets, enriched up to 98% in N^{15}, and a 6 mil CsI(Tl) crystal detector were used. Numerous angles were studied for bombarding energies between 1 MeV and 3.6 MeV. Spins and parities are discussed where resonances suggest the existence of excited states in O^{16}. Results are as follows:

E_p (keV)	Resonant mode	Spin, parity
1028	$p\alpha_0\alpha_1\gamma$	1^-
1210	$p\alpha_0\alpha_1$	3^-
1640	$p\ \alpha_1$	1^+
1890	α_0	
1985	α_1	2^-
3000	$p\alpha_0\alpha_1$	4^+
3300	$p\ \alpha_1$	2^-
3350	α_0	2^+
3520	$p\alpha_0\alpha_1$	$1^-,2^+,3^-,4^+$

At the 1210 keV resonance, the incident energy for which the α_0 yield is maximum depends on the angle of observation. This is probably the result of interference and has bearing on the spin and parity assignment of this level. The anomaly at 1890 keV cannot be positively identified as due to resonance.

539.17

11468. CROSS SECTION FOR ELASTIC SCATTERING OF PROTONS BY N^{14}. S.Bashkin, R.R.Carlson and R.A.Douglas.
Phys. Rev., Vol. 114, No. 6, 1552-3 (June 15, 1959).

The elastic scattering cross-section for protons on N^{14} was measured for bombarding energies from 900 keV to 4000 keV and for angles of 90^0, 125.3^0, 149.4^0 and 160.9^0 in the centre-of-mass system. A gas target chamber and a 6 mil thick CsI(Tl) crystal detector were used. The cross-section was measured to an absolute accuracy of ±3.5%. An anomaly was observed at 3880 ± ± 40 keV corresponding to a state in O^{15} at 11.00 MeV previously seen in the yield of gamma-rays in the $N^{14}(p,p'\gamma)N^{14}$ reaction.

539.17

11469. INELASTIC DEUTERON SCATTERING FROM Cu^{63} AND Cu^{65}. J.L.Yntema and B.Zeidman.
Phys. Rev. Letters, Vol. 2, No. 7, 309-10 (April 1, 1959).

Inelastic scattering of deuterons from Cu^{63} and Cu^{65} was found to show a gross structure in the region of 1.3 MeV excitation. Angular distributions for this region were found to have the same shape as those from the 2^+ level at 1.45 MeV in Ni^{58}. It is suggested that although there are five levels involved the gross structure

behaviour can be understood as a 0 → 2 excitation by pair rearrangement. According to Lawson and Unetsky (Abstr. 5255 of 1958) the 2^+ level in Ni^{58} is due to pair rearrangement in the neutron configuration $(f_{5/2})^2$. A.Ashmore

539.17

11470. PROPOSAL FOR A METHOD OF POLARIZING 1 MeV DEUTERONS. L.G.Pondrom.
Phys. Rev. Letters, Vol. 2, No. 8, 346-8 (April 15, 1959).

It is shown that at energies in the region of 1 MeV the elastic scattering of deuterons from He^4 yields a large deuteron polarization and a high scattering cross-section. It is suggested that such polarized deuterons may be useful in investigating (d,p) and (d,n) reactions. C.J.Batty

539.17

11471. (α,d) REACTIONS ON N^{14} AND Li^6.
B.Zeidman and J.L.Yntema.
Nuclear Phys., Vol. 12, No. 3, 298-304 (July (2), 1959).

Angular distributions of the emergent deuterons from the reactions $Li^6(\alpha,d)Be^8$ and $N^{14}(\alpha,d)O^{16}$, have been obtained for an incident alpha-particle energy of 43 MeV. The experiment was performed in the 60 in. scattering chamber, the deuterons being selected by a system employing a double NaI(Tl) crystal detector. The distributions, which cover the angular range between approximately 15° and 90° in the centre-of-mass system, exhibit oscillatory behaviour and forward peaking. Attempts to fit the data have been made. In the case of N^{14} a satisfactory fit can be obtained using spherical Bessel functions. Inclusion of some heavy-particle stripping improves the fit to the data. In the case of Li^6 it was not possible to obtain a satisfactory fit.

539.17

11472. TOTAL PHOTONUCLEAR ABSORPTION IN Al.
M.V.Mihailović, G.Pregl, G.Kernel and M.Kregar.
Phys. Rev., Vol. 114, No. 6, 1621-2 (June 15, 1959).

A direct measurement of the total photonuclear absorption in Al was carried out with improved resolution using a Compton spectrometer for analysis of the bremsstrahlung and absorption spectrum. The maximum value for the cross-section is found to be 100 ± 10 mb; the integrated cross-section is estimated to about 800 mb MeV.

539.17

11473. GAMMA-RAY ACTIVATION OF CARBON.
L.D.Cohen and W.E.Stephens.
Phys. Rev. Letters, Vol. 2, No. 6, 263-4 (March 15, 1959).

Measurement of the activation curve for the $C^{12}(\gamma,n)C^{11}$ reaction in the photon energy range 20.2 to 21.0 MeV using gamma-rays from the capture of protons in tritium. The energy resolution was of the order of 70-80 keV. The cross-section is found to vary smoothly with energy. C.J.Batty

539.17

11474. EFFECTIVE AND THERMAL NEUTRON CAPTURE CROSS SECTION AND RESONANCE CAPTURE INTEGRAL OF Pr-143.
J.C.Roy and L.P.Roy.
Canad. J. Phys., Vol. 37, No. 8, 907-15 (Aug., 1959).

The effective neutron capture cross-section, $\hat{\sigma}$, the 2200 m/sec neutron capture cross-section, σ_0 and the resonance capture integral, RI, of Pr^{143} were measured by an activation method. The values are: $\hat{\sigma}$ = 93 ± 10, σ_0 = 89 ± 10, and RI = 190 ± 25 barns respectively. The neutron fluxes were measured with cobalt monitors. All these values were calculated according to the Westcott convention, which is outlined insofar as it can be applied to activation work.

539.17

11475. DIFFERENTIAL ELASTIC SCATTERING OF 14 MeV NEUTRONS IN ALUMINUM, IRON, LEAD AND BISMUTH FOR LARGE ANGLES. K.Yuasa.
J. Phys. Soc. Japan, Vol. 13, No. 11, 1248-58 (Nov., 1958).

The absolute differential cross-sections have been measured for angles up to 170°. The neutrons generated by $T^3(d,n)He^4$ reactions were scattered by the disk-shaped scatterer, and counted by the n—α coincidence circuit with the resolving time of 4 mμsec. An anticoincidence method was used to reduce the accidental coincidences between the α-particles and the neutrons which go directly to the detector from the target. Except for the lighter nucleus, the angular distributions obtained fit fairly well with distributions based on the optical model theory employing a surface imaginary part and a real spin—orbit coupling term.

539.1

11476. THE MULTIPLE SCATTERING OF NEUTRONS AT RESONANCES. T.J.Kennett and L.M.Bollinger.
Nuclear Phys., Vol. 12, No. 3, 249-60 (July (2), 1959).

The effects of multiple scattering of neutrons at resonances have been investigated experimentally and by means of a Monte Carlo calculation. Multiple scattering in thick samples has been shown to produce a peculiar distribution in the time-of-flight spectrum, the characteristics of which have been reproduced by computation. The results of this investigation show that quantitativ information about partial cross-sections is of questionable value when multiple scattering is an important factor.

539.1

11477. THERMAL NEUTRON CROSS-SECTIONS FOR PRODUCIN SOME ISOMERS. M.L.Sehgal, H.S.Hans and P.S.Gill.
Nuclear Phys., Vol. 12, No. 3, 261-8 (July (2), 1959).

The cross-sections for the following were measured: $Pd^{108}(n,\gamma)Pd^{109m}$, $Pd^{110}(n,\gamma)Pd^{111m}$, $Sb^{121}(n,\gamma)Sb^{122m}$, $Nd^{150}(n,\gamma)Nd^{151}$, $Dy^{158}(n,\gamma)Dy^{159}$, $Hg^{196}(n,\gamma)Hg^{197m}$, $Hg^{196}(n,\gamma)Hg^{197}$, $Hg^{198}(n,\gamma)Hg^{199m}$. Scintillation techniques were used.

539.1

11478. TOTAL NEUTRON CROSS SECTIONS OF THE HYDROGEI AND HELIUM ISOTOPES. Los Alamos Physics and Cryogenics Groups.
Nuclear Phys., Vol. 12, No. 3, 291-7 (July (2), 1959).

The following experimental data are reported: for H^3 and He^3 in the energy region from about 0.2 to 20 MeV; for He^4 from 1 to 15 MeV; rather precise measurements for H^1 and H^3 at 14.10 MeV. Interesting comparisons are made with the theoretical calculations reported by Bransden, Robertson and Swan for H^3 and He^3 (Abstr. 2678 of 1957; 1663 of 1959).

539.1

11479. RESONANCE CAPTURE OF NEUTRONS IN HETEROGEN-OUS SYSTEMS. G.Blüsser.
Nukleonik, Vol. 1, No. 6, 216-21 (June, 1959). In German.

The relevant theory for resonance capture in a homogeneous system is stated. It is then shown how a transition can be made from resonance capture in a heterogeneous system to capture in an equivalent homogeneous system, using an integral equation involvin the volume integrated collision density. D.H.Lo

539.1

11480. ELASTIC SCATTERING OF 3.5 MeV NEUTRONS FROM S, Fe, Co, Ni, Cu, AND Zn.
M.K.Machwe, D.W.Kent, Jr and S.C.Snowdon.
Phys. Rev., Vol. 114, No. 6, 1563-70 (June 15, 1959).

The differential cross-section for the scattering was measure in a ring geometry using a modified Bonner-type scintillation detector. The measurements were taken over an angular range between 10° and 160°. Angular-resolution effects were removed by a suitable iterative procedure. Multiple-scattering effects were removed by an approximate analytical treatment.

539.1

11481. SLOW-NEUTRON RESONANCES IN Eu^{151} AND Eu^{153}.
F.Domanic and E.T.Patronis, Jr.
Phys. Rev., Vol. 114, No. 6, 1577-80 (June 15, 1959).

The total neutron cross-sections of Eu^{151} and Eu^{153} were meas ured between 1 and 10 eV using a high-resolution crystal spectrometer. The Breit—Wigner parameters were obtained for the 1.05 2.717, 3.368 and 3.710 eV resonances in Eu^{151}, and for the 1.725, 2.456, 3.294, 3.944, 6.16 and 8.87 eV resonances in Eu^{153}. The values of the radiation widths for the 1.055, 2.717, 3.368 and 3.710 eV resonance in Eu^{151} are almost identical, whereas out of the six resonances in Eu^{153} five are almost identical, and one is about 30% higher.

539.1

11482. $Li^6(n,t)He^4$ REACTION AT INTERMEDIATE ENERGIES.
S.J.Bame, Jr and R.L.Cubitt.
Phys. Rev., Vol. 114, No. 6, 1580-3 (June 15, 1959).

The reaction cross-section was measured in a neutron energy interval extending from 9 keV to 340 keV. The cross-section descends from 1.77 barns at 9 keV to a minimum of 0.74 barns at 100 keV before rising to a peak resonance value of 2.75 barns at 258 keV. The cross-section from 9 keV to 90 keV is not proportio to $E^{-1/2}$, but can be represented by $\sigma = 3.96\ E^{-0.907}$ with σ in barns and the neutron energy E in keV. Angular distributions of the trito are presented for neutron energies of 150, 200, 258, 300, 350, and

5 keV. These distributions, measured in a relative manner, are ced on an absolute scale by normalizing to the cross-section a of this experiment, extended to 565 keV by use of previously asured cross-sections.

539.17

483. ELASTIC AND NONELASTIC NEUTRON CROSS-SECTIONS R BERYLLIUM. J.B.Marion, J.S.Levin and L.Cranberg.
ys. Rev., Vol. 114, No. 6, 1584-9 (June 15, 1959).

A time-of-flight technique was used to measure angular tributions for the elastic scattering of neutrons from beryllium the energy range from 2.6 to 6.0 MeV. Total neutron cross-tions were also measured and the following nonelastic (total nus elastic) cross-sections obtained: 2.60 MeV (0.27 ± 0.13 barn), 0 (0.43 ± 0.10), 4.10 (0.51 ± 0.08), 5.00 (0.60 ± 0.08) and 6.00 73 ± 0.07). Differential cross-sections were also obtained for the lastic neutrons leaving Be^9 in the 2.43 MeV excited state. Integ-ion of these angular distributions yielded the following inelastic oss-sections: 3.50 MeV (0.23 ± 0.04 barn), 4.10 (0.25 ± 0.04) and 0 (0.34 ± 0.05). A continuous spectrum of neutrons was observed ich corresponds to the direct (n,2n) reaction and/or the excitation the Be^9 "level" at 1.7 MeV. This continuum was found to have an gular distribution roughly symmetric about 90°. The 2.43 MeV te of Be^9 was found to decay by neutron emission to the ground te of Be^8 with a branching ratio of 12 ± 5%.

539.17

484. SCATTERING OF 14 MeV NEUTRONS BY CARBON.
B.Singletary and D.E.Wood.
ys. Rev., Vol. 114, No. 6, 1595-9 (June 15, 1959).

Differential and total cross-sections were determined for scat-ring of 14.1 MeV neutrons from several levels in carbon. The ta were measurements of scattered neutrons made by means of e proton recoil reaction in nuclear emulsion plates. The inelastic oss-sections were 203 mb for the 4.4 MeV level, 96 mb for the 6 MeV level and 124 mb for the unresolved higher levels. The ape of the angular distribution for the 4.4 MeV level indicated the ssibility of some direct interactions. No significant amount of attering was observed due to the 7.6 MeV level. The elastic scatt-ing angular distribution showed a forward peaked diffraction type ructure and yielded a cross-section of 805 mb. Comparisons are ade with other data on the elastic and 4.4 MeV level scattering.

539.17

485. NEUTRON ACTIVATION AT 195 keV.
.S.Lyon and R.L.Macklin.
ys. Rev., Vol. 114, No. 6, 1619-20 (June 15, 1959).

Neutron activation cross-sections were measured at 195 keV 0 keV energy spread) for about 30 isotopes, by absolute gamma unting. Absolute calibration was effected by determining the iTh-D_2O neutron source strength with a flat response 4π graphite here neutron counter, and irradiating indium in the form of a thin, iform, spherical shell. The results are in general agreement with ose of other investigators. The 25 keV activation cross-sections Pr^{141}, Zr^{94}, Ga^{71}, and Pd^{108} were revised.

539.17

486. ELASTIC NUCLEUS SCATTERING OF POSITIVE -MESONS AT LOW ENERGIES. N.Schmitz.
. Naturforsch., Vol. 13a, No. 7, 507-10 (July, 1958). In German.

The differential cross-section (20-60 MeV) is calculated accord-g to the optical model for a square-well potential that permits an act solution of the Schrödinger equation inside and outside the cleus. The calculated curves are compared with experimental ta obtained from measurements in nuclear emulsions. From this mparison it seems to be obvious that the nuclear force acting upon K^--meson is repulsive also at low energies and that the corre-onding nuclear potential is rather energy-independent with a value about 15 MeV.

539.17

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also the ection entitled "COSMIC RAYS".

539.17

487. FISSION OF NON-SPHERICAL NUCLEI. A.G.Sitenko.
h. eksper. teor. Fiz., Vol. 36, No. 3, 793-7 (1959). In Russian.

Direct fission arising as a result of the transfer of a large ngular momentum to the nucleus by the absorbed particle is consid-red.

539.17

488. ANGULAR DISTRIBUTION IN THE PHOTOFISSION OF THORIUM. H.Faissner and F.Gönnenwein.
Z. Phys., Vol. 153, No. 3, 257-68 (1958). In German.

Nuclear emulsions impregnated with thorium nitrate solution were exposed to the 15.8 MeV bremsstrahlung of the Tübingen betatron. Fission tracks were identified by ionization and range, and their angular distribution relative to the incoming γ-rays was measured. As the origin of fission was unknown, the distributions obtained extend from 0° to 90° only. All tracks with a dip angle less than 50° were accepted, giving a total of 1726 events. The preponderance of fragment emission under 90° is pronounced even in the distribution of projected angles. After some calculation and correction also the distribution of true, spatial angles could be obtained from the data. Although a three-constants formula gave the best fit to the distribution observed, the quadrupole term was found not to be statistically significant. It was therefore concluded that the angular distribution is of pure dipole form with an anisotropy $\alpha = 0.55 \pm 0.12$. This is in agreement with previous counter experiments. The anisotropy is interpreted in terms of the Bohr model, some of the implications of which are discussed. Extension of the measurements to 180° might be feasible by utilizing the ionization properties of fission tracks near the origin.

539.17

489. THE CUMULATIVE FISSION YIELDS OF LIGHT MASS FRAGMENTS IN THE THERMAL NEUTRON FISSION OF Pu^{239}.
H.R.Fickel and R.H.Tomlinson.
Canad. J. Phys., Vol. 37, No. 8, 916-25 (Aug., 1959).

The relative cumulative yields of 19 light mass fragments of rubidium, strontium, yttrium, zirconium, molybdenum and ruthenium formed in the thermal neutron fission of Pu^{239} were determined with a mass spectrometer using the isotope dilution technique. The yields of the fission product isotopes of these elements, together with the previously published relative yields of three krypton isotopes, have made possible the determination of the absolute yields of 22 light fragment mass chains.

539.17

490. THE CUMULATIVE FISSION YIELDS OF 21 HEAVY MASS NUCLIDES PRODUCED IN THE THERMAL FISSION OF Pu^{239}.
H.R.Fickel and R.H.Tomlinson.
Canad. J. Phys., Vol. 37, No. 8, 926-36 (Aug., 1959).

Mass spectrometric analysis of caesium, barium, cerium, neodymium, and samarium produced in the thermal fission of Pu^{239} has made possible the determination of the cumulative yields of 17 mass chains. With previously published mass spectrometric yields of four xenon isotopes normalized to the present data a total of 21 cumulative yields are reported.

539.17

491. CALCULATED ACTIVITIES AND ABUNDANCES OF U^{235} FISSION PRODUCTS. R.C.Bolles and N.E.Ballou.
Nuclear Sci. Engng, Vol. 5, No. 3, 156-85 (March, 1959).

Computed disintegration rates and numbers of atoms (abundances) of each fission-product radionuclide at various times after simultaneous slow-neutron fission of 10 000 atoms of U^{235} are presented. These results are based on fission yields from two different theories of independent fission yields. The computations treat both known and unknown fission product radionuclides. Half-lives and yields of the latter were estimated. The disintegration rate, number of active and inactive atoms, total number of atoms, and the percentage contribution to total activity and to the total number of atoms are presented for each element and for each chemical group of elements. The disintegration rate of the total fission-product mixture according to each independent yield theory is also presented.

539.17

492. FAST FISSION FACTOR AND COLLISION PROBABILITY IN MODERATOR-FILLED URANIUM TUBES (CALCULATED BY STATISTICAL METHODS). H.Rief.
Nukleonik, Vol. 1, No. 6, 208-15 (June, 1959). In German.

A general expression for the fast fission factor is derived for fuel tubes filled with a moderator, using the various mean collision probabilities in the moderator and fuel. These probabilities were determined by the Monte-Carlo method for uranium tubes of various radii when filled with D_2O and when empty. The accuracy of the statistical method used is discussed. D.H.Lord

539.17

11493. INVESTIGATIONS ON THE POSSIBLE DEFLECTION OF THERMAL NEUTRON CURRENTS. H.Völcker.
Atomkernenergie, Vol. 3, No. 8-9, 295-8 (Aug.-Sept., 1958). In German.

In general, thermal columns in reactors produce a horizontal current of neutrons; however, a vertical current offers some advantages. The possibility of changing the direction of the current from horizontal to vertical is investigated by means of diffusion theory. In an optimal assembly, it is shown that a rotation in a solid corner of moderator is not feasible. A calculation, based on the albedo concept, shows that a solution of the problem is given by a prismatic hollow corner, consisting of graphite walls one diffusion length thick, which connects two mutually perpendicular cubic columns. The result is discussed as a function of geometry.

539.17 : 536.212

11494. THE QUESTION OF TEMPERATURE DISTRIBUTION IN A VERY LONG UNSHEATHED, CYLINDRICAL FUEL ELEMENT IN THE UNSTEADY STATE (HEATING UP). W.Kattwinkel.
Atomkernenergie, Vol. 3, No. 8-9, 342-5 (Aug.-Sept., 1958). In German.

The partial differential equation of heat conduction is solved. Use is made of the Laplace transformation. The inversion integral problem is thoroughly treated. In a typical case, after 1 sec, the temperature of the outer surface exceeds that on the axis; but these conditions are reversed 1 sec later. After 50 sec, the temperature distribution almost attains its steady state distribution, the difference being less than 4 per cent. The maximal temperature difference within the fuel element occurs after attaining steady state distribution.

539.17

11495. CRITERIA FOR THE CALCULATION OF THE CONSTANTS OF THE TWO-GROUP METHOD. G.Casini and G.Rossi.
Energia nucleare, Vol. 7, No. 7, 472-8 (July, 1959). In Italian.

The two-group model of neutron diffusion is set down in a way that leads to a self-consistent form for the constants, which is suitable for making calculations directly. The mathematical formalism is outlined. The inadequacies of this model, when applied to uranium–graphite reactors, are discussed and methods of overcoming them (by proper correlation of experimental data) are suggested.

539.17

11496. "NUCLEONICS" SURVEY OF OPERATING CRITICAL FACILITIES IN THE U. S.
Nucleonics, Vol. 16, No. 12, 44-45 (Dec., 1958); Vol. 17, No. 5, 146, 148 (May, 1959).

539.17

11497. FLOWABLE SOLIDS REACTOR. M.R.Dusbabek.
Nucleonics, Vol. 17, No. 4, 132-6 (April, 1959).

A proposal for a thermal reactor in which the fuel is in the form of a flowable powder of UO_2 with a particle size of 200 μ. The powder flows by gravity down 3 in. diameter ceramic-lined channels spaced in a graphite moderator. The hot powder from bottom of the core gives up heat to a heat-exchanger and is returned to the top by a mechanical conveyor. R.D.Smith

539.17

11498. CONSTRUCTION WORK ON THE REACTOR ISPRA-I. G.Franco.
Nuovo Cimento Suppl., Vol. 11, No. 3, 361-5 (1959). In Italian.

Ispra-I is a heterogeneous reactor with M.T.R.-type fuel plates, D_2O cooled and moderated, and with a graphite reflector. Uranium is 20% enriched and the thermal power 5 MW. There are about 30 horizontal and vertical holes with diameters up to 30 cm, two special channels for isotope production and four pneumatic rabbits. The reactor is now 50% complete and should be ready for operation next spring. Precautions taken to ensure the integrity of the heavy water circuit, the accuracy and purity of the graphite reflector and the efficiency of the biological shield are described. The reactor building is 27 m in diameter and 25 m high and there are three air-locks for access. The article includes ten photographs showing the present state of the reactor. R.D.Smith

539.17

11499. TEMPERATURE CALCULATIONS IN HETEROGENEOUS THERMAL REACTORS. A.Zmysłowski.
Nukleonika, Vol. 3, No. 6, 615-31 (1958). In Polish.

Formulae are derived for calculating: (1) the coolant and sheath surface temperatures; (2) the rise of the fuel element temperature as a function of the power generated in the fuel channel; and (3) the distribution of thermal neutrons. For the maximum sheath surface temperature a formula identical with that given by Ginns has been obtained. The rise of the fuel element temperature is discussed for two cases: that of the solid cylindrical rod and that of an annular rod (tube). F.Lachma

539.1

11500. SCATTERING AND THERMALIZATION OF NEUTRONS BY BOUND NUCLEI. J.A.Janik.
Nukleonika, Vol. 4, No. 3, 241-52 (1959). In Polish.

Problem of inelastic scattering and thermalization of neutron in polycrystalline moderators is briefly discussed. Detailed discussion of the same problem is given for the case of moderators containing hydrogen. In particular, experimentally obtained cross-sections and ξ-parameters values, as a function of neutron energy are compared with the theory for various moderators.

539.1

11501. THE RELATION BETWEEN THE REACTOR PERIOD AN THE MULTIPLICATION FACTOR IN THE SUBCRITICAL STATE. W.Baran.
Nukleonika, Vol. 4, No. 3, 253-64 (1959). In Polish.

An expression was found for the reactor period T as a functi of the multiplication factor in the subcritical state (i.e. before attaining $k_{ef} = 1$). This facilitates the preparation of T(k) diagram in order to calibrate the reactivity meter and the periodmeter.

539.1

11502. NOTE ON THE PHYSICAL SIGNIFICANCE OF THE IMPORTANCE FUNCTION IN LINEAR REACTOR KINETICS. D.Emendörfer.
Nukleonik, Vol. 1, No. 4, 128-31 (Dec., 1958). In German.

The adjoint to the stationary neutron distribution or to the lowest eigenfunction is known as the importance function of a reactor. The importance functions are established and illustrated for critical and super-critical reactors with delayed neutrons. The reactors studied are ones in which the carriers of the delayed neutrons remain at their points of origin, e.g. a reactor with compact fuel. D.H.Lor

539.

11503. INVESTIGATION OF FUEL CHANGING IN A REACTOR AND ITS EFFECT ON BURN-UP. A.Zeigler.
Nukleonik, Vol. 1, No. 4, 140-9 (Dec., 1958). In German.

The maximum burn-up attainable and the power density is affected by the spatial distribution of elements of different irradiation lifetime within the core. By means of a suitable programme of fuel element shuffling it is shown that it is possible to fulfil three important conditions of an almost stationary distributi of power density, a uniform burn-up of all fuel elements, and an optimum compromise between power density and burn-up from th point of view of minimum cost per kWhr. C.G.Morg

539.17 : 539.

11504. ESTIMATION OF THE HEATING-UP OF THERMAL NEUTRONS IN THE FUEL ELEMENTS OF HETEROGENEOUS REACTORS. A.Müller.
Nukleonik, Vol. 1, No. 5, 172-4 (April, 1959). In German.

In a heterogeneous reactor, the thermal neutron spectrum in the fuel elements differs from that in the moderator because, on t average, the neutrons gain energy by scattering in the hotter fuel. Expressions for the energy transference to a neutron by scatterin in monatomic gases, molecular gases and crystalline solids are reviewed. From these the mean energy elevation is found for a neutron in a fuel element. D.H.Lo

539

11505. CELL CALCULATION FOR A HETEROGENEOUS REACTOR BY THE THREE-GROUP DIFFUSION THEORY. H.Ri
Nukleonik, Vol. 1, No. 5, 175-82 (April, 1959). In German.

The neutron flux density and importance function in a many-z cylindrical system are found analytically from three group diffus theory. A numerical calculation is carried out for a three-zoned cell of a D_2O reactor, giving neutron distribution and multiplicati factor K_∞. In this calculation epithermal U^{235} fission is taken int account so that the factor ϵ for fast fission and p for resonance capture can be defined adequately. The results obtained are com pared with those from single group theory. D.H.Lo

539.17

1506. NEUTRON SPECTRUM IN HETEROGENEOUS PLATE EACTORS. W.Häfele.
ukleonik, Vol. 1, No. 6, 197-208 (June, 1959). In German.

Following on from the work of Meetz, the neutron flux distribution is determined, exactly, as a function of position and lethargy for e cases when the uranium absorption cross-section is independent f energy and when it is a power law of the energy. From this it is hown that the spectrum at the position of the uranium plates is hard- dependent on the scattering cross-section, when the absorption ross-section follows a V^{-1} law. The energy dependence of the ourier components of the flux distribution is determined numeric- lly. D.H.Lord

539.17

1507. THE GENERAL EXPRESSION FOR THE AVERAGE LIFE- IME OF NEUTRONS IN MULTIGROUP DIFFUSION THEORY AND OR A [CRITICAL] REACTOR OF M DIFFERENT MEDIA.
..Y.Özemre.
ukleonik, Vol. 1, No. 7, 248-50 (Aug., 1959).

539.17 : 614.898

CONCRETE IN RADIATION-SHIELDING TECHNIQUE. See bstr. 10480

ATOMS

539.18 : 523.752

THE HIGH-TEMPERATURE EXCITATION OF IONIZED ELIUM. See Abstr. 10538

539.18

1508. ON QUASICLASSICAL SINGLE-ELECTRON FUNCTIONS. . BOUND STATES. N.I.Zhirnov.
Optika i Spektrosk., Vol. 4, No. 2, 125-37 (Feb., 1959). In Russian. English summary : PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Using a corrected Thomas—Fermi potential, an approximate W.K.B. representation of single-electron radial wave-functions for silver and indium is obtained in analytic form. The calculated X-ray intensities are found to be in satisfactory agreement with experimental data. W.A.Hepner

539.18

11509. ON QUASICLASSICAL SINGLE-ELECTRON FUNCTIONS. I. CONTINUOUS SPECTRUM STATES. N.I.Zhirnov.
Optika i Spektrosk., Vol. 4, No. 2, 138-43 (Feb., 1959). In Russian. English summary : PB 141047T-1, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The method of Pt I (preceding abstract) is used to show that, at sufficiently high energies in the continuous spectrum, the radial functions are very similar to those for hydrogen. W.A.Hepner

539.18

11510. IMPROVED ANALYTICAL ONE-ELECTRON WAVE-FUNCTIONS. S.D.Budrite, L.L.Kuzmitskite and V.K.Shugurov.
Optika i Spektrosk., Vol. 6, No. 2, 245-7 (Feb., 1959). In Russian.

The authors show how to find analytical functions which would give the same or nearly the same results as one-electron functions which are solutions in Fok's self-consistent field (1930). Fok's equations are written down in the momentum space and solved by successive approximations, starting with hydrogen functions. This procedure was used to calculate wave-functions of helium-type atoms (He, Li^+, Be^{++} and B^{+++}) in their ground state.
A.Tybulewicz

539.18

11511. CALCULATION OF THE S—P MATRIX ELEMENTS OF THE HELIUM ATOM. W.Romberg.
K. Norske Vidensk. Selsk. Forhandl., Vol. 31, No. 19, 117-24 (1958; publ. 1959). In German.

The author's earlier work (Abstr. 2209 of 1947) is extended to the calculation of the matrix elements of helium using corrected Rydberg numbers. Complex integrals are developed and tables given for the nS—NP transitions of para- and ortho-helium. The results are compared with those of other workers; good agreement is obtained for para-helium. Differences for ortho-helium are attributed to the fact that other workers have used series formulae which become divergent for large n whereas the complex integrals remain calculable. P.Young

539.18

11512. GROUND-STATE ENERGY OF HELIUM.
Yu.N.Demkov, M.G.Neigauz and R.V.Senyukov.
Optika i Spektrosk., Vol. 4, No. 6, 709-14 (June, 1958). In Russian. English summary: PB 141047T-11, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The problem of finding energy levels for a helium atom in the non-relativistic approximation reduces to finding of stationary values of a certain functional J. The functional J has a lower bound. Its smallest extremal value λ is the value required and it determines the ground-state energy. The problem was solved by the Ritz method which gives an approximation for the extremal eigenvalue. This eigenvalue is always on the energy spectrum side. Applying this method to the J functional, an approximate energy value L is found which is the upper bound for the true eigenvalue λ. The lower bound for λ was found using the Maehly method (Abstr. 5267 of 1953). The calculations were made using the BESM computer. Approximate values of the ground-state energy above and below the true eigenvalue were found. They are given as $-2.9040855 < \lambda < -2.9037202$.

539.18

11513. THE TYPE OF CORRELATION FUNCTION FOR THE HELIUM ATOM.
V.B.Glasko, V.P.Maslov, V.I.Panikar and N.D.Sokolov.
Optica i Spektrosk., Vol. 6, No. 5, 698-700 (May, 1959). In Russian.

Correlation in the motion of electrons is allowed for in molecular calculations by the introduction into the wave-function of an additional multiplier which depends on the inter-electron separation r_{ij}. In analogy with the first approximation in the helium-atom calculations of Hylleraas (1929), this multiplier can be written for a two-electron system in the form

$$f(r_{12}) = 1 + \alpha r_{12},$$

where α is a variational parameter. In the general case, the correlation function should depend on three correlation variables and f can be then represented as a series in powers of these variables. When only one correlation variable is used the choice of the function $f(r_{12})$ in the form given by the above equation is an arbitrary one. The present note shows that, in fact, the form given above represents the best possible choice. A.Tybulewicz

539.18

11514. EFFECT OF HARD CORES ON THE BINDING ENERGIES OF H^3 AND He^3. II. T.Ohmura, M.Morita and M.Yamada.
Progr. theor. Phys., Vol. 17, No. 3, 326-30 (March, 1957).

The results are given of calculations with two-body forces of the Yukawa type which are cut off by hard cores. Only central forces are used and the force parameters are determined from the two-nucleon data at low energies as was done in Pt I (Abstr. 8322 of 1956). This change in the radial form of the nuclear force does not alter the qualitative features of the effects of hard cores: (1) Hard cores reduce the binding energies of H^3 and He^3. (2) Hard cores extend the wave-functions of H^3 and He^3, so that the Coulomb energy of He^3, which is too large without the hard cores, is brought into agreement with the experimental value of the difference between the binding energies of H^3 and He^3.

539.18

11515. QUANTUM-ELECTRODYNAMICAL CORRECTIONS TO ENERGY-LEVELS OF HELIUM. H.Araki.
Progr. theor. Phys., Vol. 17, No. 5, 619-42 (May, 1957).

Quantum-electrodynamical corrections to energy levels of helium are calculated with an accuracy of $\alpha^5 mc^2$ on the basis of the Bethe–Salpeter equation according to the perturbation method of Fulton and Karplus. The interaction kernel of the equation is derived according to the method of Martin and Schwinger. The corrections are carefully calculated and the result is expressed in terms of non-relativistic eigenfunctions. It is found for $\alpha^5 mc^2$ corrections that correction factors for spin—orbit and spin—spin couplings are in complete agreement with those derived by Araki. It is found that the $\alpha^4 mc^2$ terms involve a contact interaction but not the Breit surplus term. Further it is found that the energy correction for the excited bound-state includes an imaginary part. The ground-state energy is real. The absolute value of the imaginary part represents half the width of the level in question.

539.18 : 539.12

11516. HYPERFINE SPLITTING EFFECTS IN THE CAPTURE OF POLARIZED μ-MESONS. H.Uberall.
Phys. Rev., Vol. 114, No. 6, 1640-5 (June 15, 1959).

The effect of the hyperfine splitting of μ-mesic atom ground states on the neutron asymmetry from muon capture in hydrogen, in deuterium, and in complex nuclei with spin which are treated by a one-particle model. It is shown that this can provide more information on the capture interaction than the neutron asymmetry from spinless nuclei. Muon polarizations and gyromagnetic ratios in the hyperfine states are also discussed.

539.18

11517. THEORETICAL CONSIDERATIONS ON THE POSSIBILITY OF A NEW METHOD FOR SEPARATING MIXTURES AND ISOTOPES. A.Witkowski.
Acta phys. Polon., Vol. 16, No. 1-2, 79-91 (1957).

This method is based on the superposition and mutual intensification of the thermal diffusion (the boundary conditions being different from the usual ones) and distillation processes. The phenomenological theory of the method is set up. A numerical example shows that there exists a possibility of increasing by several times (average 15 times) the degree of separation in an isotope mixture at equilibrium as compared with the separation obtained under similar conditions when using thermogravitational or distillation methods alone.

539.18

11518. EXCHANGE OF NITRIC OXIDE WITH WATER IN NITRIC ACID SOLUTIONS AS A MEANS OF CONCENTRATING OXYGEN-18. T.I.Taylor and J.C.Clarke.
J. chem. Phys., Vol. 31, No. 1, 277-8 (July, 1959).

Exchange of O^{18} between NO and H_2O by the reaction

$$NO^{16}(g) + H_2O^{18}(l) \rightleftharpoons NO^{18}(g) + H_2O^{16}(l)$$

in single-stage experiments with 6M-HNO_3 indicated a rather rapid approach to equilibrium and a single-stage enrichment factor of 1.020 ± 0.002. An exchange column 25 mm I.D., 150 cm long, filled with a stainless steel packing was run for several days to get steady state separation, being fed mainly with N-oxides from a N^{15} column. The maximum overall separation was 2.55, which with the experimental single-stage enrichment factor of 1.02 indicates 48.7 stages for a 5 cm column, or 3.1 cm per stage, compared with 2.6-2.9 cm for a similar column for N^{15} concentration. The method appears promising and is being further developed.

R.C.Murray

539.18 : 533.15

11519. DOES CATALYSIS SHIFT THE SEPARATION-TUBE EQUILIBRIUM? G.Dickel.
Z. Electrochem., Vol. 63, No. 1, 14-17 (1959). In German.

A theory is derived of a Clusius–Dickel separation tube in which catalytic processes take place. It is shown that the catalysis has no effect on the equilibrium but merely accelerates the speed at which the equilibrium is attained.

H.London

539.18 : 531.711

11520. ATOMIC BEAM SOURCES AND THE STANDARD OF LENGTH. K.G.Kessler, R.L.Barger and W.G.Schweitzer.
I.R.E. Trans Instrumentation, Vol. I-7, No. 3-4, 181-4 (Dec., 1958).

Three devices which utilize the wavelength of optical transitions in an atomic beam of mercury as a standard of length are described: (1) a beam of atoms excited by electron impact; (2) a beam in absorption which utilizes a Michelson interferometer to produce a narrow line in emission; and (3) a beam in absorption utilized as a narrow band detector. The half-width of the 2537 A line, observed in both emission and absorption, is 0.002 cm^{-1} and is equivalent to a coherence limit of 500 cm. The comparable half-widths for the 5462 A mercury and the 6058 A krypton lines produced in cooled discharge tubes are 0.018 cm^{-1} and 0.011 cm^{-1}.

539.18 : 538.27 : 621.316.727

ATOMIC-BEAM MAGNET-STABILIZATION SYSTEM. See Abstr. 11241

539.18 : 539.14

11521. DETERMINATION OF THE HYPERFINE-STRUCTURE SPLITTING OF THE $^2D_{3/2}$ AND $^2D_{5/2}$ GROUND STATES OF SCANDIUM, AND THE QUADRUPOLE MOMENT OF THE Sc^{45} NUCLEUS. G.Fricke, H.Kopfermann, S.Penselin and K.Schlüpmann.
Naturwissenschaften, Vol. 46, No. 3, 106 (1959). In German.

Using an atomic-beam resonance method 5 hyperfine-structure intervals were determined, and a provisional value of the quadrupole moment of Sc^{45} is given as $Q(Sc^{45}) = (-0.22 \pm 0.01) \times 10^{-24}$ cm

S.J.St-Lor

539.18 : 539.

11522. COULOMB DEFLECTION EFFECTS ON IONIZATION AN PAIR-PRODUCTION PHENOMENA. J.Bang and J.M.Hansteen.
K. Danske Vidensk. Selsk. mat.-fys. Medd., Vol. 31, No. 13, 43 pp (1959).

The process of K-ionization of atoms by heavy, charged parti is analysed by a semi-classical, time-dependent perturbation method. Non-relativistic wave-functions are used for the atomic electrons. The deflection of the bombarding particle in the Coulo field of the target nucleus is shown to play an important part in th calculation of cross-sections in the low-energy region of the proj ile. Numerical calculations of K-ionization cross-sections for protons turn out to be in good agreement with recent light-target experiments. An estimate is made of the effect of using relativis electron wave-functions in the present perturbation treatment. T method developed is further applied to the pair-production proces caused by slow protons impinging on a heavy target element.

539

11523. RESONANCE PHENOMENA IN LARGE-ANGLE HELIUM ION–HELIUM ATOM COLLISIONS. F.P.Ziemba and E.Everhart
Phys. Rev. Letters, Vol. 2, No. 7, 299-301 (April 1, 1959).

Experimental results are given showing a series of peaks in the yield of neutral He atoms scattered at 5°, as the energy E of He^+ ions bombarding He atoms is varied up to 250 keV. The high energy peaks are equally spaced on a scale proportional to collis time ($\sqrt{E}$). It is suggested that the results may be understood in terms of multiples of the time taken for an electron to jump to a helium ion, there being continual transfers backwards and forwar

A.Ashm

MOLECULES

539.19 : 51

11524. TABLE OF LIGAND FIELD INTEGRALS. C.J.Ballhausen and E.M.Ancmon.
K. Danske Vidensk. Selsk. mat. fys. Medd., Vol. 31, Paper 9, 37 pp. (1958).

The integrals tabulated are the radial parts of the electron interaction integrals between hydrogen-like orbitals and their first and second derivatives with respect to r_o, the distance from the metal ion to the ligand. $\int R(3d)(r_<^n/r_>^{n+1})R(3d)r^2dr$ and its derivatives are tabulated for n = 0,2,4, $Z_{3d} = 3.65 \rightarrow 7.85$, $r_o/a_o = 3.40 \rightarrow 4.20$. The similar integral for (3d,4s) is tabulated for n = 2, $Z_{3d} = 3.65 \rightarrow 7.85$, $Z_{4s} = 2.5 \rightarrow 5.0$, $r_o/a_o = 3.40 \rightarrow 4.20$. T integral for (3d,4p) and its first derivative are given for n = 1,3, $Z_{3d} = 3.65 \rightarrow 7.85$, $Z_{4p} = 3.0 \rightarrow 4.25$, $r_o\ a_o = 3.4 \rightarrow 4.2$. The integ for (4s,4s) is given for n = 0, $Z_{4s} = 2.5 \rightarrow 5.0$, $r_o/a_o = 3.0 \rightarrow 5.0$.

J.Hawg

539

11525. THEORY OF THE HYDRIDE MOLECULES, BASED ON THE UNITED ATOM MODEL. R.Gáspar and I.Tamássy-Lentei.
Ann. Phys. (Leipzig), Folge 7, Vol. 2, No. 3-4, 208-16 (1958). In German.

A variational method is used for calculating the various proj ties of molecules, using a united atom model in which the geome cal arrangement of atomic nuclei in the molecule has been prese while the eigenfunction of the molecule has been developed by Sla method from the single-centre/single-electron eigenfunctions. T values calculated for HF, H_2O and $(HO)^-$ (total energy, nuclear di tance, energy of dissociation) agree well with experimental resu

F.Lachu

53

11526. METHODS OF APPROXIMATION OF MOLECULAR INTEGRALS. I. S.Huzinaga.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1189-99 (Oct., 1958).

The Mulliken and the Sklar approximations for difficult mole integrals have for some years been the subject of several invest gations. So far, however, no clear insight into these approximat methods has been obtained and, accordingly, there is no reliable criterion for the choice between them for each individual case. I

is paper a possible answer to the problem is presented by examining carefully the accuracies of these two methods. In addition, a new approximate method is proposed, which is useful when both the Mulliken and the Sklar approximations break down.

539.19

11527. THE FORCE CONSTANTS OF SOME POLYATOMIC MOLECULES AND IONS. T.A.Hariharan.
J. Indian Inst. Sci. A, Vol. 40, No. 3, 89-96 (July, 1958).

The force constants of the molecules phosphorus oxybromide and thiophosphoryl bromide and the ions $GaBr_4^=$, $TlBr_4^=$ and $CdBr_4^=$ were evaluated using the known fundamental vibration frequencies. The matrix method of Wilson was used in all cases. The value of the P = O force constant was nearly the same as found in the molecule $OPCl_3$ and the P—Br force constant was also nearly the same in $OPBr_3$ and $SPBr_3$. However, there was some difference between the values of the P = S force constant in $SPBr_3$ and $SPCl_3$.

539.19

11528. CORRESPONDENCE IN ANALYTICAL TREATMENTS OF VIBRATIONAL TRANSITION PROBABILITIES OF DIATOMIC MOLECULES. N.R.Tawde, B.S.Patil and M.I.Savadatti.
Bull. Soc. Roy. Sci. Liege, Vol. 28, No. 5-6, 150-4 (May-June, 1959).

Two analytical methods, due to Hutchisson and Mannebeck, for the calculation of vibrational transition probabilities have been compared and it is shown that the expressions obtained for the overlap integrals are identical. One method may thus be used to check the results obtained by use of the other. R.C.Seymour

539.19

11529. THE FUNDAMENTAL FREQUENCIES OF ALL THE DEUTERATED BENZENES. APPLICATION OF THE COMPLETE ISOTOPIC RULE TO NEW EXPERIMENTAL DATA.
S.Brodersen and A.Langseth.
K. Danske Vidensk. Selsk. mat.-fys. Skr., Vol. 1, No. 7, 36 pp. (1959).

The complete isotopic rule discussed previously (see Abstr. 3377 of 1957) is used to calculate all the fundamental frequencies of the various partly deuterated benzenes from those of benzene-d_0 and benzene-d_6. The calculated frequencies are compared with new experimental values obtained in this laboratory. All non-planar frequencies are given by strictly valid rules. In order to calculate the planar frequencies it is necessary to introduce an approximation based on the separation of high and low frequencies. No correction for anharmonicity is required. A detailed discussion is given of the setting up of the rules, especially of the approximate ones. The agreement between calculated and observed frequencies is very satisfactory. Frequencies calculated from strictly valid rules usually agree within 0-3 cm^{-1}, those calculated from approximate rules within 0-10 cm^{-1}. A first-order approximation is proposed and shown to be of great value for surveying the changes in vibrational frequencies caused by changes in the isotopic substitution.

539.19 : 533.7

ROTATIONAL AND VIBRATIONAL RELAXATION IN DIATOMIC GASES. See Abstr. 10694

539.19 : 539.12

THEORETICAL CALCULATIONS OF THE SLOW NEUTRON SCATTERING CROSS SECTION OF THE ETHYLENE MOLECULE. See Abstr. 11370

539.19 : 539.2

POLYTYPISM AND THE ORIGIN OF THE POTENTIAL BARRIER HINDERING INTERNAL ROTATION IN MOLECULES. See Abstr. 10258

539.19

11530. THE TRANSMISSION OF ELECTRONIC EFFECTS THROUGH A PALLADIUM ATOM. J.Chatt, L.A.Duncanson and L.M.Venanzi.
J. Chem. Soc., 1958, 3203-7 (Sept.).

The N—H stretching frequencies and band intensities of a series of palladous complexes trans-$[L,am PtCl_2]$ [L = PR_3, $P(OR)_3$, AsR_3, R_2S, R_2Se, R_2Te, piperidine, and n-octylamine; "am" = piperidine, n-octylamine, and p-toluidine] have been measured. The effects transmitted from the ligand L across the palladium atom to the N—H bond are mainly electrostatic. There appears to be direct interaction between the n-hydrogen atom and filled d-orbitals of the metal. The frequency—intensity relationship and the half-band widths of the piperidine complexes are discussed.

539.19

11531. CALCULATION OF THE ABSORPTION SPECTRUM OF BENZENE BASED ON A METALLIC MODEL TAKING INTO ACCOUNT PERIODIC POTENTIAL AND π-ELECTRON INTERACTION. L.A.Borovinskii.
Optika i Spektrosk., Vol. 4, No. 2, 156-67 (Feb., 1958). In Russian. English summary: PB 141047T-1, obtainable from Office of Technical Services, U.S.Dept. of Commerce, Washington, D.C., U.S.A.

Criticizes the approaches in Abstr. 7596 (1956) and 6391 (1957), and treats the interaction of the π-electrons by assuming separability of motion along and perpendicular to the benzene ring. The singlet—singlet and singlet—triplet transition energies are calculated, and agree reasonably with experiment except for $^1A_{1g}-E_{1u}$. J.Hawgood

539.19

11532. CHARGE-TRANSFER TRANSITION IN Cl_2^+.
V.Venkateswara Rao and P.Tiruvenganna Rao.
Indian J. Phys., Vol. 32, No. 11, 534-5 (Nov., 1958).

It is suggested that the band systems I and III of Cl_2^+ (Abstr. 4298 of 1956) arise from charge transfer transitions. Comparisons are made with other known charge transfer transitions of O_2 and O_2^+. R.W.Nicholls

539.19

11533. LONG-RANGE NUCLEAR SPIN—SPIN COUPLINGS IN THIOPHENE DERIVATIVES. P.L.Corio and I.Weinberg.
J. chem. Phys., Vol. 31, No. 2, 569-70 (Aug., 1959).

Spin—spin couplings, of magnitudes 0.4 and 1.1 c/s, between protons separated by four and five chemical bonds, have been observed in the nuclear magnetic resonance spectra of both 2- and 3-methyl thiophene. E.F.W.Seymour

539.19 : 535.37

11534. THE LOWER EXCITED STATES AND THE PHOSPHORESCENT STATE OF DIPHENYL. II. SCHEME OF MODIFICATION OF MO. K.Iguchi.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1186-9 (Oct., 1958).

For Pt I, see Abstr. 8722 (1959). A new method is proposed for the problem of phosphorescence of alternant hydrocarbons to take account of the mixing of higher order AO's. A theoretical scheme is given for the modification of the $2p\pi$ MO with the addition of 3d AO's for the diphenyl molecule. With the modified MO's thus obtained, the singlet—triplet intercombination matrix is given in concrete form.

539.19

11535. THE CALCULATION OF INTERATOMIC DISTANCES FROM BOND INDICES AND DENSITIES.
J.I.Fernandez-Alonso, J.L.Oliete and R.Domingo.
J. Chim. phys., Vol. 56, No. 6, 548-54 (June, 1959). In French.

Values of interatomic distances for sixteen aromatic hydrocarbons with 4, 5 or 6 benzene rings have been calculated by the free-electron approach and compared with LCAO results; there is good agreement throughout. J.Hawgood

539.19

11536. DIPOLE MOMENTS OF SOME SUBSTITUTED BENZENES AND PYRIDINES. III. CHLORO-AND BROMO ETHYL BENZENES. C.R.K.Murty.
Indian J. Phys., Vol. 32, No. 10, 492-6 (Oct., 1958).

See also Abstr. 3992 of 1959. The dipole moments of six ethyl substituted benzenes were determined in dilute solution in benzene. The effects of methyl and ethyl groups on other substituents in the benzene ring are discussed in the light of the observed moments.

539.19

11537. DIPOLE MOMENTS OF ATACTIC AND ISOTACTIC POLYSTYRENE. W.R.Krigbaum and A.Roig.
J. chem. Phys., Vol. 31, No. 2, 544-5 (Aug., 1959).

Describes experiments in which it was established that the dipole moment in toluene solution of isotactic polystyrene is larger than that of the atactic form. J.Hawgood

539.19

11538. ON THE LENGTH OF THE CARBON—CARBON SINGLE BOND. L.S.Bartell.
J. Amer. Chem. Soc., Vol. 81, No. 14, 3497-8 (July 20, 1959).

Evidence is presented that intramolecular van der Waals forces can affect bond lengths appreciably. The C—C bond is discussed,

in particular, and it is shown that gauche repulsions in the conventional reference, diamond, may account for the 0.01 A difference between bonds in the diamond and n-hydrocarbons. Other factors governing bond lengths in hydrocarbons are discussed briefly.

539.19

11539. CALCULATION OF THE PROBABILITY OF VIBRATIONAL EXCITATION OF MOLECULES BY COLLISIONS. E.E.Nikitin.
Optika i Spektrosk., Vol. 6, No. 2, 141-45 (Feb., 1959). In Russian.

Using methods of the theory of non-stationary perturbations, the author has calculated the cross-section for inelastic collisions of diatomic molecules which are accompanied by excitation of vibrations. It was assumed that the energy of intermolecular interaction may be represented by a Lennard-Jones potential and that the angular dependence of the interaction does not affect the order of the cross-section. The author allowed for the change of the relative energy of the colliding molecules before and after collision, since this affects the value of the cross-section. A.Tybulewicz

539.19

11540. MODEL CALCULATION OF THE TEMPERATURE DEPENDENCE OF SMALL MOLECULE DIFFUSION IN HIGH POLYMERS. W.W.Brandt.
J. phys. Chem., Vol. 63, No. 7, 1080-4 (July, 1959).

An expression has been derived for the activation of small molecule diffusion in high polymers in terms of the intermolecular and intramolecular interactions and of the number of degrees of freedom involved in the molecular motion. The result has been used to calculate diffusion coefficients and their temperature dependence on the basis of Barrer's "zone" theory [J. phys. Chem., Vol. 61, No. 2, 178 (1957)]. The resulting Arrhenius activation energies are 30 to 75% of the experimental ones. The reason for this is discussed. The approach indicates that the change of the activation energy at the glass transition found experimentally in many polymers can be understood as a consequence of the change of the thermal expansion coefficient at this point. Certain details of molecular structure, such as the shape of the potential barrier of hindered rotation and the number of degrees of freedom per monomer unit, are found to have only a small effect on the resultant diffusion properties. The calculated effect of the penetrant molecule's size on the activation energy is in good agreement with experimental data.

539.19

11541. ON THE VISCOSITY OF IRRADIATED POLYMERS. I. M.Inokuti.
J. Phys. Soc. Japan, Vol. 14, No. 1, 79-85 (Jan., 1959).

The change of the intrinsic viscosity of a polymeric substance due to irradiation with high-energy radiations is discussed for various types of initial molecular size distributions. It is shown that the intrinsic viscosity can at first decrease in certain cases by irradiation, even if it reaches infinity finally at the gel point. It is further concluded that such a behaviour of the intrinsic viscosity is possible, only if the initial molecular size distribution is sufficiently broad.

539.19 : 529.786 : 621.317.361

CONSIDERATIONS ON THE DESIGN OF A MOLECULAR FREQUENCY STANDARD BASED ON THE MOLECULAR BEAM ELECTRIC RESONANCE METHOD. See Abstr. 10552

SOLID-STATE PHYSICS

539.2 : 532.7

11542. MAXWELL–AMPERE CONFERENCE — LONDON, 1959.
Arch. Sci. (Geneva), Vol. 12, Special No., 251 pp. (1959).

This conference, the 8th Colloque Ampere, was held in London, 1-3 April 1959, in collaboration with the British Radiofrequency Spectroscopy Group. It was devoted to the subject "Molecular and atomic motions in solids and liquids by radiofrequency methods". Forty-three papers are presented, some of them in summary form. Abstracts of the papers not published elsewhere will be found under the appropriate headings in this or subsequent issues of "Science Abstracts". [For a review of the conference, see Nature (London), Vol. 184, 157-8 (July 18, 1959)].

539.

11543. FORMULAE GIVING THE APPROXIMATE ELECTROSTATIC ENERGY OF A SPACE CHARGE. O.Emersleben.
Naturwissenschaften, Vol. 46, No. 2, 64-5 (1959). In German.

A very brief note outlining calculations of the potential energy in arrays of finite size (crystals etc.). Shape factors are briefly considered. J.D.Cragg

539.2 : 536.

11544. THEORY OF SOLID He^3. N.Bernardes and H.Primakoff.
Phys. Rev. Letters, Vol. 2, No. 7, 290-2 (April 1, 1959).

The properties of solid He^3 at pressures around 30 atmospher and temperatures $< 1^\circ K$ have been calculated making certain assu tions. The results of the calculation include (1) the r.m.s. deviatic of an atom from its lattice site as 0.36 of the nearest neighbour di tance; (2) the cohesive energy per atom as about $2.5^\circ K$; (3) the tem perature dependence of magnetic susceptibility, and an antiferromagnetic configuration in the ground state; (4) a specific heat anom aly at about $0.2^\circ K$; (5) a negative expansion coefficient below about $0.5^\circ K$; (6) predicted cooling of solid He^3 by adiabatic compression below about $0.5^\circ K$; (7) pressure–temperature melting curves with minimum near $0.4^\circ K$. Failure to observe this last minimum is ascribed to experimental inadequacy. L.Mackinn

539

11545. RELATIONSHIP OF HARDNESS, ENERGY GAP AND MELTING POINT OF DIAMOND TYPE AND RELATED STRUCTUI G.A.Wolff, L.Toman, Jr, N.J.Field and J.C.Clark.
Semiconductors and phosphors. See Abstr. 9597. pp. 463-9.

Hardness, energy gap, and melting point are closely related t type and strength of bonding, and consequently to lattice energy. T Knoop microhardness values H of the Group IV B elements, of SiC of the III—V compounds and of some II—VI compounds are found t obey Goldschmidt's relation $H = Ar^{-m}$ where A is constant, r is t interatomic distance, and the index m = 5 for the elements and SiC and $m \cong 9$ for the III—V compounds. Similar relations are found for the optical gap width and for the melting point of these materi J.B.Bir

539

11546. A CALCULATION OF THE LIMITING VALUES OF THE ACTIVATION ENERGY FOR VARIOUS PROCESSES IN SOLID METALS. K.A.Osipov.
Dokl. Akad. Nauk SSSR, Vol. 121, No. 4, 637-9 (1958). In Russian.

The author extends the hypothesis that various activated processes in solid metals are due to differing numbers of atoms being excited in a similar way; i.e. $\Delta H = nq$, where q is more or l a constant for a given metal. An estimate of q can be obtained fr the difference in free energy between the solid and liquid states. Values of q obtained in this way are given for a large number of metals and the results appear as a periodic function of atomic number. M.G.Priest

539

11547. SYMMETRY OF WURTZITE. R.C.Casella.
Phys. Rev., Vol. 114, No. 6, 1514-18 (June 15, 1959).

The symmetry analysis of wurtzite, performed originally by Dresselhaus at the origin of the Brillouin zone, is extended. A method is employed at the zone boundaries which is considerably simpler than the standard procedure. Optical selection rules for band-to-band transitions in the neighbourhood of $k = 0$ are re-examined. It is found that light polarized perpendicular to the c axis should be absorbed more strongly than light polarized along c axis, independently of the symmetry types of the initial and fina states, unless they have the same symmetry, which is unlikely. T result is in agreement with experiment for CdS and ZnS.

539

11548. PERIODIC POTENTIAL IN METALS. Y.Siotu.
Sci. Rep. Tohoku Univ. First Ser., Vol. 62, No. 4, 173-81 (Dec., 1958).

The mean inner potential and the Fourier coefficients are calculated by Bethe's method [Ann. Phys. (Leipzig), Vol. 8, 55 (1928)]. The results are given in tables.

539.2 : 548.7

11549. WHISKER CRYSTALS WITH STRENGTH NEAR TO THE THEORETICAL.
E.M.Nadgornyi, Yu.A.Osip'yan, M.D.Perkas and V.M.Rosenberg.
Uspekhi fiz. Nauk, Vol. 67, No. 4, 625-62 (April, 1959). In Russi

A review with 91 references, dealing with the subject under t headings: production, orientation and form of whiskers; the mech ism of growth; mechanical properties; other properties. R.F.S.Hearm

539.2

550. ON THE FORMATION OF DISLOCATION SUBSTRUCTURE JRING GROWTH OF A CRYSTAL FROM ITS MELT.
Washburn and J.Nadeau.
:ta metallurgica, Vol. 6, No. 11, 665-73 (Nov., 1958).

Dislocation networks in as-grown lithium fluoride crystals were udied by etch pit and decoration techniques in an attempt to obtain perimental evidence concerning the origin of grown-in dislocations veral mechanisms for formation of new dislocation loops at or near growing crystal face were considered. The kinds of distribution served, and the insensitivity of the grown-in networks to the growth te and temperature gradient in the solid, were considered to be th the hypothesis that stresses are responsible for most of the own-in dislocations.

539.2

551. LATTICE DEFECTS IN ZINCBLENDE. I. PHENOMENO-)GICAL EXPRESSIONS OF INTERIONIC POTENTIALS.
Asano and Y.Tomishima.
Phys. Soc. Japan, Vol. 13, No. 10, 1119-26 (Oct., 1958).

As the basis of calculation on formation energies of lattice fects, phenomenological expressions of interionic potentials are rived. In zincblende crystal which is partly ionic and partly valent the effective charge on the constituent ions is reduced to quantity Ze (Z = 1.66), whereas covalent attraction between two ns adjacent to each other is generated, which is assumed to be the form $-b_c \exp(-r/\rho_c)$ similar to the usual expression of change repulsion. As a preliminary calculation to Pt II, the ttice energy variation when one anion or cation is displaced from s regular position in a perfect crystal is calculated taking account the Madelung—Van der Waals exchange repulsion, covalency traction and polarization energies of the displaced ion and all her surrounding ions. All the physical constants already known e tabulated.

539.2

552. LATTICE DEFECTS IN ZINCBLENDE. II. FORMATION NERGY OF LATTICE DEFECTS. S.Asano and T.Tomishima.
Phys. Soc. Japan, Vol. 13, No. 10, 1126-37 (Oct., 1958).

The formation energies of various types of lattice defects in incblende are calculated by means of Mott–Littleton's method. phenomenological expression of interionic potential which con-tins the covalency binding energy is used in the calculation. In ddition, the total energy when the lattice around a defect is not in quilibrium is computed at several positions of the surrounding ions f the defect near the equilibrium point. The results of calculation how that the formation energies of the Schottky defect, the double ole and the Frenkel defect by zinc ions are estimated to be ~ 6 eV. The result that the formation energy of the Schottky efect is nearly equal to that of the double hole is qualitatively in greement with the experimental results which have been obtained ith a pure host crystal of ZnS phosphor.

539.2 : 537.311.31

LATTICE DEFECTS OF A GOLD—COPPER ALLOY.
ee Abstr. 10960

539.2

553. CONTINUOUS DISTRIBUTIONS OF DISLOCATIONS. . TWISTING UNDER CONDITIONS OF SINGLE GLIDE.
.A.Bilby and L.R.T.Gardner.
roc. Roy. Soc. A, Vol. 247, 92-108 (Sept. 9, 1958).

For Pt IV, see Abstr. 4429 (1958). The theory of continuous istributions of dislocations is applied to discuss the geometrical eatures of the twisting of a cylindrical crystal deforming by single lide. It is first assumed that the strains are small, and that the islocations arrange themselves so as to produce no far-reaching tress, and explicit expressions for the shape changes, lattice otations and dislocation distribution are derived. The theory is in easonable agreement with the observations of Whapham and Vilman (1956) when the angle of twist per unit length is not too arge. The expression for the shape of the glide surfaces is much impler than that derived by Whapham and Wilman, who also applied small strain approximation, but not consistently. It is shown that he consistent reduction of the complicated expression of these uthors leads to the simple one of the present theory. Further, the orrect shape of the glide surfaces for large strains is also derived sing the boundary conditions employed by Whapham and Wilman. his predicts an asymmetry of the type observed in a severely wisted crystal before correction of the observations for macro-copic bending, although the predicted asymmetry is rather too large.

539.2 : 548.736.1

ATOM MOVEMENTS AND DISLOCATION STRUCTURES FOR PLASTIC SLIP IN SINGLE CRYSTALS OF β-URANIUM.
See Abstr. 10371

539.2 : 538.27

ANISOTROPY OF NUCLEAR MAGNETIC RESONANCE DUE TO CRYSTAL DISLOCATIONS. See Abstr. 11262

539.2

11554. A MODIFICATION OF THE THERMODYNAMIC DEFECT TYPES IN CRYSTALS. B.Eckstein.
Z. phys. Chem. (Leipzig), Vol. 208, No. 5-6, 319-24 (April, 1958). In German.

A qualitative discussion of defects in crystals.

P.T.Landsberg

539.2

11555. ON THE VIBRATION OF DISORDERED LINEAR LATTICE.
J.Hori and T.Asahi.
Progr. theor. Phys., Vol. 17, No. 4, 523-42 (April, 1957).

The method of transfer matrix which was developed by Kerner to treat the problem of the electronic band structure of mixed linear lattices was applied to the problem of vibration of atomic linear chains. It was shown that this method affords effective means of calculating the eigenfrequency-distribution of several kinds of lattices, including disordered ones. The well known results for regular monatomic and diatomic lattices, and the results which were obtained by Montroll and Potts for linear lattices containing a few impurity atoms, were rederived by the matrix method in a much simpler way. The eigenvalue equations for the lattices containing several impurities at arbitrarily given positions were then derived. In cases where the force constant is not altered by impurities the formulae become so simple that one can obtain the eigenfrequencies without laborious calculations. It is also possible to derive in such cases a simple approximate eigenvalue equation for lattices containing impurities distributed completely at random. This equation indicates that the mode of change in the distribution of eigenfrequencies is qualitatively the same as in the case of one or two impurities. A monatomic lattice with a single hole and diatomic lattice with a single impurity were treated as simple examples. An attempt to extend the matrix method to the case in which the next-nearest interaction between atoms is taken into account is also mentioned.

539.2

11556. LATTICE VIBRATIONS IN SILICON AND GERMANIUM.
B.N.Brockhouse.
Phys. Rev. Letters, Vol. 2, No. 6, 256-8 (March 15, 1959).

Dispersion curves (frequency v. reduced wave number) for lattice vibrations in the [001] direction of a silicon single crystal have been measured by neutron diffraction. The four branches agree well with the form predicted by other measurements. New measurements for Ge resolve an apparent discrepancy between the new results for Si and previous similar measurements on Ge.

C.A.Hogarth

539.2

11557. LATTICE VIBRATIONS IN SILICON BY SCATTERING OF COLD NEUTRONS.
H.Palevsky, D.J.Hughes, W.Kley and E.Tunkelo.
Phys. Rev. Letters, Vol. 2, No. 6, 258-9 (March 15, 1959).

A cold-neutron beam produced by filtration through an 8 in. Be slab was normally incident on a (100) plane of a silicon single crystal. The energy of neutrons scattered at 90° was measured from their time-of-flight. From the results and infrared data the energies of the Raman line and of one acoustical branch were estimated and were in close agreement with the values obtained by Brockhouse (see preceding abstract). The results suggest that long-range forces act in Si as well as Ge.

C.A.Hogarth

539.2

11558. THEORY OF THE LATTICE VIBRATIONS OF GERMANIUM.
W.Cochran.
Phys. Rev. Letters, Vol. 2, No. 12, 495-7 (June 15, 1959).

The Born—von Karman theory is extended to apply to a model of the germanium crystal in which each atom is treated as a charged core coupled isotropically to an oppositely charged shell of negligible mass. It is claimed that good agreement is obtained with experimentally observed dispersion curves and that there is some theoretical justification for the model.

J.W.Leech

PA7

539.2

11559. ON THERMAL TRANSITION PROCESS OF ELECTRONS IN SOLIDS. R.Kubo.
Semiconductors and phosphors. See Abstr. 9597. pp. 584-7.

A brief critical survey of the present stage of the theory of electronic transition processes thermally induced in solids.

J.B.Birks

539.2 : 535.37

THERMO-OPTICAL LIBERATION OF ELECTRONS FROM TRAPPING LEVELS IN ALKALI-HALIDE PHOSPHORS.
See Abstr. 10832

539.2

11560. LATTICE SCATTERING MOBILITY OF ELECTRONS IN CADMIUM SULPHIDE. H.Miyazawa, H.Maeda and H.Tomishima.
J. Phys. Soc. Japan, Vol. 14, No. 1, 41-7 (Jan., 1959).

The Hall mobility of electrons was measured between 90° and 400°K for dark-conducting CdS:Ga, CdS:Cl and CdS:Cd single crystals. The lattice scattering mobility after correction is well given by equation $\mu_L = A\{\exp(\Theta/T) - 1\}$ with $A = 92.5 \pm 15$ cm²/(V sec) and $\Theta = 370° \pm 30°$K. There are thus about $10^{17} \sim 10^{18}$ uncontrollable deep-lying centres per unit volume in the crystals, which permanently capture the conduction electrons and act as scatterers. The value of the characteristic temperature seems to be reasonable as compared with the one ($\Theta = 250 \sim 300°$K) previously obtained by Krőger et al. (Abstr. 3752 of 1955) from the infrared absorption band ($\Theta' = 335°$K) and the fine structure data in the edge emission ($\Theta = 460°$K).

539.2

THEORY OF INELASTIC SCATTERING OF ELECTRONS IN METALS. See Abstr. 8616-17

539.2

11561. INTERACTION OF CONDUCTION ELECTRONS WITH ACOUSTIC PHONONS. N.Mikoshiba.
J. Phys. Soc. Japan, Vol. 14, No. 1, 22-30 (Jan., 1959).

The interaction is studied from a general point of view. Parmenter's theory of acousto-electric effect in the high-frequency range is criticized for several reasons. It is shown that Weinreich's relation between acousto-electric effect and the absorption coefficient of acoustic waves holds only in the high-frequency range, and the limitation to its application is also discussed. The new magneto-acoustic resonance suggested by the present author is examined qualitatively.

539.2

11562. ON THE QUANTUM-MECHANICAL CALCULATION OF THE SCATTERING OF FREE EXCITONS BY PHONONS IN A MOLECULAR CRYSTAL. A.S.Selivanenko.
Optika i Spektrosk., Vol. 4, No. 1, 92-5 (Jan., 1958). In Russian.
English summary : PB 141047T-3, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

Theoretical study of exciton diffusion by Davydov's methods, assuming weak intermolecular forces. The scattering probability is found as the sum of the probabilities of scattering with emission and with absorption of a phonon. J.Hawgood

539.2 : 535.343

MULTIPLET STRUCTURE OF EXCITONS IN CdS.
See Abstr. 10774

539.2

11563. INFRARED CYCLOTRON RESONANCE AND MAGNETO-OPTICAL BAND GAP EFFECTS IN InSb.
E.Burstein, G.S.Picus and H.A.Gebbie.
Semiconductors and phosphors. See Abstr. 9597. pp. 370-5.

Measurements were made of the cyclotron resonance transmission and reflection curves at a wavelength of 41.1 μ for intrinsic specimens of InSb using applied magnetic fields up to 50 kilogauss. The effect of such magnetic fields in displacing the intrinsic absorption edge of InSb was also studied. Some preliminary results, using thinner (10 μ) specimens, are reported which show several peaks in the intrinsic absorption spectrum of InSb at fields as low as 15 kilogauss. J.B.Birks

539.2

11564. CYCLOTRON ABSORPTION IN METALLIC BISMUTH AND ITS ALLOYS.
J.K.Galt, W.A.Yager, F.R.Merritt, B.B.Cetlin and A.D.Brailsford.
Phys. Rev., Vol. 114, No. 6, 1396-413 (June 15, 1959).

Extensive studies are reported. Experimentally, a microwave cavity arrangement is used which causes circularly polarized radiation to be incident on the sample. The samples are disks which form part of the cavity wall during the experiment. A sign is observed which is under most conditions proportional to the change in the fractional power absorption of the sample as the ma netic field applied to the sample is changed. The experiment is done with this field in the plane of the sample as well as normal t it. When the magnetic field is normal to the sample surface, circ arly polarized radiation distinguishes between the effects of hole and of electrons. Making this distinction is complicated in bismu by the anisotropy of the band structure, but it is not impossible. pure bismuth the number of holes equals the number of electrons alloying with tin increases the relative number of holes and alloy with tellurium increases the relative number of electrons. The experiments have been done at both 24 000 and 72 000 Mc/s. The tilted ellipsoid model of the electron band, and the ellipsoid of r olution model for the hole band have been used in a classical magneto-ionic theory of the effect which fits the data taken with magnetic field normal to the sample surface quite satisfactorily. The fit between this theory and the experiment is substantial confirmation of the validity of this band model, and makes it possible with the aid of certain infrared observations to determine the par meters of the model numerically. The mass parameters obtained for an ellipsoid in the electron band are $m_1 = 0.0088$, $m_2 = 1.80$, $m_3 = 0.02323$, $m_4 = \pm 0.16$, while those for the hole band are $M_1 = 1$ $= 0.068$ and $M_3 = 0.92$. Comparison is made with similar results obtained from magnetoresistance and de Haas–van Alphen exper ments. The experiments done with the magnetic field in the plan the sample have been used to improve the accuracy of the determ ination of cyclotron resonance fields and therefore of the masses of the charge carriers, although no quantitative theory of the ove all shape of the signal under these conditions is available.

5

11565. CYCLOTRON RESONANCE EFFECTS IN ZINC.
J.K.Galt, F.R.Merritt, W.A.Yager and H.W.Dail, Jr.
Phys. Rev. Letters, Vol. 2, No. 7, 292-4 (April 1, 1959).

Measurements were made at 1.3°K, at both 24 kMc/s and 72 kMc/s, with the steady magnetic field either parallel or perpe dicular to the plane specimen surface ($H_{\parallel}$ or $H_{\perp}$). With $H_{\perp}$, resu were difficult to interpret; with $H_{\parallel}$, Azbel–Kaner type oscillatio (Abstr. 2395 of 1957; and 8850 of 1959) were found, indicating a carrier of effective mass $m^* = 0.55\ m_0$ for $H_{\parallel}$ along a six-fold a and $m^* = 0.43\ m_0$ for $H_{\parallel}$ along a two-fold axis. R.G.Chamb

539.2 : 53

11566. DETECTION OF COLLOIDAL CENTERS IN LITHIUM HYDRIDE BY ELECTRON RESONANCE.
W.T.Doyle, D.J.E.Ingram and M.J A.Smith.
Phys. Rev. Letters, Vol. 2, No. 12, 497-9 (June 15, 1959).

A narrow electron paramagnetic resonance line with intensi independent of temperature, and an optical absorption band centr at 650 mμ, have been observed in lithium hydride after irradiati with ultraviolet light. These effects are attributed to colloidal centres of lithium metal. E.F.W.Seym

5

11567. EFFECTS OF SPIN–ORBIT COUPLING IN RARE EART METALS, AND IN SOLUTIONS OF RARE EARTH METALS.
R.Brout and H.Suhl.
Phys. Rev. Letters, Vol. 2, No. 9, 387-9 (May 1, 1959).

An exchange interaction of the f-shell spins with the conduct electron spins has been thought to be responsible for the ferro-magnetism and/or antiferromagnetism and the large electrical resistance of the rare earth metals, and for the reduction in the superconducting transition temperature of lanthanum on addition of rare earth elements. It is pointed out that the theoretical predictions concerning these effects may be appreciably changed by the inclusion in the theory of spin–orbit coupling.

E.F.W.Seyn

539.2 : 535

OPTICAL ABSORPTION AND ENERGY LEVELS IN THE OX OF VITREOUS GERMANIUM. See Abstr. 10796

5

11568. CONNECTION BETWEEN TRUE EFFECTIVE MASS AN OPTICAL ABSORPTION IN INSULATORS.
V.Ambegaokar and W.Kohn.
Phys. Rev. Letters, Vol. 2, No. 9, 385 (May 1, 1959).

Assuming a small number of free carriers in the conductio band and taking into account the Coulomb interaction between the the results of a calculation are given which lead to the connectio mentioned in the title. K.W.Pleas

539.2 : 535.37

QUANTUM YIELD OF F-FLUORESCENCE. See Abstr. 10807

539.2

569. ON THE QUANTUM YIELD OF COLOUR CENTRES IN ALKALI HALIDES. K.P.Sinha.
sci. industr. Res., Vol. 17B, No. 9, 379-81 (Sept., 1958).

Expressions are derived for the conversion efficiencies of F ntres to F' centres and vice versa, as functions of temperature d concentration of centres. J.Franks

539.2

570. COLOR CENTER FORMATION IN SODIUM CHLORIDE. W.Etzel and J.G.Allard.
ys. Rev. Letters, Vol. 2, No. 11, 452-4 (June 1, 1959).

The colour centre formation in synthetic crystals was compared th that in natural crystals using 40 kVp X-rays, 2 MeV electrons d 1.2 MeV γ-rays. The number of F-centres created per unit sorbed energy agreed within 30% for the X-rays and 2 MeV ectrons but was down by a factor of 3 for the γ-rays. The growth rves (number of F-centres v. energy absorbed) with X-radiation re different for synthetic and natural crystals; this difference is ributed to hydroxyl ion impurity in the synthetic crystals. B.T.M.Willis

539.2

571. ON THE KINETICS OF F-CENTRE FORMATION BY LECTRON IRRADIATION. F.Fischer.
Phys., Vol. 154, No. 5, 534-52 (1959). In German.

Single crystals and evaporated layers of LiF, NaF_2 and NaCl re irradiated at 90°K with 5 keV electrons. The increase of F-ntre absorption as a function of absorbed energy was followed to turation. The temperature conditions for evaporation strongly fluence the saturation concentration of F-centres. The build up of centres can be expressed as a sum of exponential functions. Only e function is involved for single crystals of NaCl and two for LiF d NaF crystals. G.F.J.Garlick

539.21 : 534.23

IRRADIATION EFFECTS IN SOLIDS. ULTRASONIC TTENUATION AND DISLOCATIONS PINNING. See Abstr. 10712

539.21

572. BEHAVIOR OF THIN METAL SURFACE FILMS UNDER LECTRON BOMBARDMENT. C.C.Hsiao.
ta Metallurgica, Vol. 6, No. 9, 606-9 (Sept., 1958).

Surface layers stripped from tinplate were found to be amor-ous by electron diffraction. However, the action of the electron am itself initiated shrinkage and crystallization; this was shown subsequent electron microscopy and diffraction. A.E.I. Research Laboratory

539.21

573. EFFECTS OF IONIZING RADIATIONS ON POLYETHYLENE. Shinohara, A.Amemiya and A.Danno.
Phys. Soc. Japan, Vol. 13, No. 6, 604-8 (June, 1958).

Polyethylene films were irradiated in the air by deuterons celerated by a cyclotron and by gamma-rays from a cobalt-60 urce. Gel fraction, swelling ratio, weight changes and infrared sorption spectra of irradiated specimens were measured. It was und that the specimen irradiated by deuterons was cross-linked d became insoluble in xylene. The effects of deuteron irradiation em almost the same as those of other ionizing radiations such as le or gamma-rays. Infrared absorption spectra reveal some fference in that the ratio of E_{CO}/E_{CC} is 0.65 in the deuteron irradi-ion and is smaller than the value of 14.0 resulting from gamma-y irradiation, where E_{CO} is the optical density of carbonyl groups d E_{CC} that of unsaturation. Some considerations are given on the ssible explanation of this difference.

539.21 : 541.182.5

GEL FORMATION OF POLYVINYL ALCOHOL SOLUTIONS RADIATED BY γ-RAYS. See Abstr. 10351

539.21 : 537.311.33

CONDUCTIVITY INDUCED BY RADIATION IN POLYCRYSTAL-NE CADMIUM SULPHIDE AND POLYETHYLENE. e Abstr. 10990

539.21

574. EFFECTS OF ELECTRON BOMBARDMENT UPON ROMIDES OF CADMIUM AND SILVER. S.Suzuki.
ature (London), Vol. 183, 1755-6 (June 20, 1959).

Differences in behaviour of various metals under electron mbardment are attributed to differences in crystal structures. J.Adam

539.21

11575. ESTIMATION OF THE VOLUME OF THE "FISSION SPIKE" IN URANIUM. Y.Quéré and F.Nakache.
J. nuclear Mater., Vol. 1, No. 2, 203-9 (July, 1959). In French.

The number of lattice defects formed in uranium by neutron irradiation shows a rapid saturation which can be demonstrated by electrical conductivity measurements. This saturation arises from the existence of a region of intense thermal agitation, the "fission" spike", associated with each fission. In this region pre-existing defects are annihilated. A diminution of defects at the temperature of irradiation (room temperature) is superimposed on this effect. It is possible to disentangle these two effects and determine that the volume of the "fission spike" is $2.10 \pm 0.20 \times 10^{-16}$ cm^3.

539.21

11576. CONCERNING THE SPIKE FORMATION IN RADIATION DAMAGE BY CHARGED PARTICLES. U.Gonser.
Nukleonik, Vol. 1, No. 5, 182-3 (April, 1959). In German.

Discusses qualitatively the mechanism of spike-formation by neutral and charged particles and concludes that optimum conditions for spikes to appear prevail towards the end of the particle trajectory. S.J.St-Lorant

539.21

11577. RECOVERY OF ELECTRON-IRRADIATED COPPER. I. CLOSE PAIR RECOVERY.
J.W.Corbett, R.B.Smith and R.M.Walker.
Phys. Rev., Vol. 114, No. 6, 1452-9 (June 15, 1959).

Stage I recovery (14-65°K) of electron-irradiated, high-purity copper is shown to be composed of at least five substages: I_A, 14-24°K; I_B, 24-28.5°K; I_C, 28.5-33°K; I_D, 33-48°K and I_E, 48-65°K. I_A, I_B, and I_C recovery are discussed in further detail. I_B and I_C and shown to have the characteristics of close-pair recovery. It is inferred that I_A also has these characteristics. The values of the activation energy for recovery are $E_A = 0.05 \pm 0.01$ eV, $E_B = 0.085 \pm 0.01$ eV, and $E_C = 0.095 \pm 0.01$ eV. An attempt to relate the observed close-pair spectrum to specific interstitial-vacancy configurations is described.

539.21

11578. RECOVERY OF ELECTRON-IRRADIATED COPPER. II. INTERSTITIAL MIGRATION.
J.W.Corbett, R.B.Smith and R.M.Walker.
Phys. Rev., Vol. 114, No. 6, 1460-72 (June 15, 1959).

Several experiments are presented dealing with substages I_D and I_E of Stage I (14°K-65°K) recovery in electron-irradiated pure copper. It is concluded that both I_D and I_E represent the recovery due to the free diffusion of a defect, presumably an interstitial atom, with an activation energy for motion $E_m = 0.12 \pm 0.005$ eV. I_D is the result of correlated recovery (the interstitial returns to the vacancy from which it came) while I_E is the result of uncorrelated recovery (the interstitial travels to a distant sink). The migrating interstitial is shown to interact with vacancies, traps, and other interstitials leading respectively to annihilation, trapping, and cluster formation. The interaction between two interstitials leading to cluster formation is found to be comparable with the annihilation interaction between an interstitial and a vacancy. Clusters containing more than two interstitials are also formed. Previous work in copper is discussed, and it is concluded that this previous work is consistent with the above description of Stage I recovery. The relationship of the present work to the general problem of assigning defect processes to the higher temperature recovery states in copper is also discussed.

539.21 : 537.311.33

RECOMBINATION PROPERTIES OF BOMBARDMENT DEFECTS IN SEMICONDUCTORS. See Abstr. 10978

539.21 : 537.311.33

RADIATION EFFECTS IN SEMICONDUCTORS. See Abstr. 10979

539.21 : 537.311.33

RADIATION-PRODUCED ENERGY LEVELS IN COMPOUND SEMICONDUCTORS. See Abstr. 10980

539.21 : 537.311.33

IRRADIATION OF SEMICONDUCTORS. See Abstr. 11004

539.21 : 537.311.33

NATURE OF BOMBARDMENT DAMAGE AND ENERGY LEVELS IN SEMICONDUCTORS. See Abstr. 11008

539.21 : 537.311.33

DISORDERED REGIONS IN SEMICONDUCTORS BOMBARDED BY FAST NEUTRONS. See Abstr. 11009

539.21 : 537.311.33

ELECTRON-BOMBARDMENT INDUCED RECOMBINATION CENTRES IN GERMANIUM. See Abstr. 11007

539.21 : 537.311.33

RADIATION EFFECTS ON RECOMBINATION IN GERMANIUM. See Abstr. 11006

539.21 : 537.311.33

HIGH-ENERGY ELECTRON IRRADIATION OF GERMANIUM AND TELLURIUM. See Abstr. 11010

539.21 : 537.311.33

IRRADIATION DAMAGE IN GERMANIUM AND SILICON DUE TO ELECTRONS AND GAMMA RAYS. See Abstr. 11012

STRUCTURE OF SOLIDS

539.213

11579. THE STUDY OF THE TRANSITION PHENOMENA OF CHAIN POLYMERS BY THE PHOTOELASTIC METHOD.
M.Kaneko.
J. Phys. Soc. Japan, Vol. 13, No. 11, 1324-8 (Nov., 1958).

It is reported that the glass transition phenomena of chain polymers can be studied by observing the temperature dependency of the photoelasticity of the materials. The transition temperature determined using this method agrees with the second order transition point by the specific volume method for P.V.C., but for polystyrene it is a little higher and rather near to the softening point by the dynamical elastic method.

539.213

11580. FORMATION OF AMORPHOUS SOLIDS AND CHARACTERIZATION OF THEIR STRUCTURES BY ENERGY PROFILES.
W.A.Weyl and E.C.Marboe.
J. Soc. Glass Technol., Vol. 43, 191T-210T (June, 1959).

There are four ways of producing amorphous silica. Cooling molten silica gives a glass; precipitating silica from an aqueous medium gives a gel; mechanical deformation (polishing) of quartz gives an amorphous surface layer; and bombardment of quartz with α-particles or neutrons produces an amorphous solid which resembles metamict minerals. The structures of amorphous solids are described by the potential energies which are vested in their surfaces and defects. The effect of these energies on the kinetics of solid state reactions is shown by using the densification of Vycor glass and the formation of cristobalite from silica gel as examples.

539.215

11581. COMPARISONS BETWEEN FREE ENERGIES OF ACTIVATION FOR GRAIN GROWTH, GRAIN-BOUNDARY SELF-DIFFUSION, AND LIQUID SELF-DIFFUSION.
E.L.Holmes and W.C.Winegard.
Canad. J. Phys., Vol. 37, No. 8, 899-906 (Aug., 1959).

A comparison is made between the free energies of activation for boundary migration during normal grain growth, grain-boundary self-diffusion, and liquid self-diffusion. The equality of these, within the accuracy of experiment and analysis, supports the assumption of identical elementary processes in the three cases. A detailed discussion is given regarding the various constants used in the equations from which the free energies of activation of the above-mentioned processes are derived.

539.217

11582. SELF-DIFFUSION IN DILUTE BINARY SOLID SOLUTIONS. III. DIFFUSION IN SILVER GERMANIUM AND SILVER THALLIUM SOLUTIONS. R.E.Hoffman.
Acta metallurgica, Vol. 6, No. 2, 95-7 (Feb., 1958).

For previous work, see Acta metallurgica, Vol. 3, 417 (1955) and Vol. 5, 74 (1957). The diffusivities of silver in silver-thallium solutions and of thallium and germanium in pure silver and their corresponding solutions were measured. These data, and published solute and solvent diffusion data for silver—lead and silver—copper solutions, are in good agreement with predictions based on a previously proposed model for diffusion in dilute solid solutions.

539.2

11583. THE CALCULATION OF THE DIFFUSION COEFFICIEN IN SOLID BODIES. R.Sh.Malkovich.
Fiz. tverdogo Tela, Vol. 1, No. 4, 606-12 (April, 1959). In Russia

The thin-layer approximation commonly used to interpret the diffusion of a radioactive tracer into a solid is not applicable, ev for layers much thinner than the penetration depth, if the diffusing substance has too low a solubility in the bulk material. Simple pl are suggested for the alternative case of constant concentration (saturation) at the surface. The corrections due to finite thickness and non-parallel alignment, in sectioning or grinding to various depths, are re-discussed, the treatment by previous writers being generalized to the present case. The expression is found to be in fact unaltered, but is given here in a more complete form.

I.D.C.Gurn

539.2

11584. ON THERMAL DIFFUSION EFFECT IN THE SURFACE TREATMENT OF METALS BY DIFFUSION OUT OF A STREAMI GAS. V.C.Liu.
J. appl. Phys., Vol. 30, No. 6, 950-1 (June, 1959).

Points out that the separation of molecules of different mass in a temperature gradient has implications on the method of surface treatment of metals suggested by Wagner. This method consists in passing a stream of gas, containing a component whic it is desired shall enter the metal, over the hot metal surface. T temperature gradient in the gas causes a concentration gradient i the diffusing component. A numerical example is given.

L.G.Carpen

539.2

11585. DIFFUSION PROCESSES IN POLYMERS UNDER IRRADI TION; POLYVINYL ALCOHOL AND CCl_4 SYSTEM. T.Watanabe
J. Phys. Soc. Japan, Vol. 13, No. 11, 1316-24 (Nov., 1958).

When the PVA film is irradiated in CCl_4, PVA is swollen an cross-linked. A phenomenological theory is proposed for this experiment. It is suggested that with the change of diffusion cons tant CCl_4 enters into PVA as the radiation dose increases, and th radicals from CCl_4 react upon PVA and cause cross-linking. Th results of calculation agree reasonably with experiments, that is the weight changes of swollen polymers against the total dose, th gel fraction changes and the viscosity average molecular weight changes in sol fractions against the total dose. Other mechanism that can be considered are discussed.

539

11586. STUDY OF THE SELF-DIFFUSION OF γ-PHASE URANIUM. Y.Adda and A.Kirianenko.
J. Nuclear Mater., Vol. 1, No. 2, 120-6 (July, 1959). In French.

Studied at temperatures ranging from 800° to 1 050°C. The diffusion couples used were made of natural uranium and uraniu enriched with U^{234}. The samples were sectioned on a precision lathe after treatment. The α-emission of the cut surface was measured by means of an ionization chamber. The self-diffusio coefficient in the γ-phase, the activation energy (Q = 27.5 kcal p g atm) and the frequency factor ($D_0 = 1.8 \times 10^{-3}$ cm^2 sec) were determined from the activity—penetration curves established by means of this technique.

539

11587. THEORY OF THE GAS PERMEABILITY OF PLASTIC SHEETING [AND FILMS]. A CRITICAL LITERATURE SURVEY
N.Buchner.
Kunststoffe, Vol. 49, No. 8, 401-6 (Aug., 1959). In German.

539.217 : 5

11588. NUCLEAR MAGNETIC RESONANCE DETERMINATION ACTIVATION VOLUME FOR DIFFUSION IN LITHIUM.
R.G.Barnes, R.D.Engardt and R.A.Hultsch.
Phys. Rev. Letters, Vol. 2, No. 5, 202-4 (March 1, 1959).

The use of N.M.R. techniques to measure the activation vol for self-diffusion in solids is discussed. A relationship betwee activation volume and the N.M.R. spin—spin relaxation time is derived. Measurements were made of line breadths for Li^7 in l metal dispersed in mineral oil, as a function of pressure up to 3000 atmospheres, at 3° and at 27°C. Values obtained for the a tion volumes are

$$V_{act} = 5.10 \pm 0.25 \text{ cm}^3 \text{ at } 3°\text{C}$$

$$V_{act} = 5.18 \pm 0.25 \text{ cm}^3 \text{ at } 27°\text{C}.$$

S.A.

539.217

589. DIFFUSION-COUPLE ANALYZER FOR USE WITH THE E. XRD DIFFRACTOMETERS. J.B.Cohen.
v. sci. Instrum., Vol. 30, No. 8, 639-41 (Aug., 1959).

Equipment is described to analyse diffusion couples and phase undaries by means of X-ray absorption, in conjunction with the E.-XRD diffractometers. Analysis may be carried out automatic-ly with the system described here over a minimum distance of μ. The equipment will not interfere with normal diffraction work er the range 0-106°2θ, therefore, can be left fixed to the diffracto-eter when not in use.

539.217

590. SELF-DIFFUSION IN SOLID LITHIUM.
N.Naumov and G.Ya.Rŷskin.
n. tekh. Fiz., Vol. 29, No. 2, 189-91 (1959). In Russian.

A composite specimen was made by pressing together the micro-med ends of two cylinders — one of natural Li (7.5% Li^6), the other riched in Li^6 (88.5% Li^6); after diffusion, the distribution of Li^6 was easured using 5 μ microtomed layers and a mass spectrometer. ne expected error function distributions were obtained and each ecimen provided about 20 values of D, the self-diffusion coefficient, r the temperature used. About 20 such specimens were measured ing annealing times up to 70 hr and temperatures 70°-170°C. The sults fitted the relation $D = D_0 \exp(-U/RT)$ closely, with $_0 = 0.39 \pm 0.02$ cm²/sec and $U = 13.49 \pm 0.07$ kcal/g mol. These lues are in excellent agreement with the results of Holcomb and orberg (Abstr. 7227 of 1955) who used a spin resonance method. hey also agree with Hojima's theoretical estimates (Abstr. 7743 of 56) based on a vacancy mechanism of diffusion. K.F.Hulme

539.219 : 539.42

591. SOLUTE HARDENING OF CLOSE-PACKED SOLID OLUTIONS. P.A.Flinn.
cta metallurgica, Vol. 6, No. 10, 631-5 (Oct., 1958).

The contribution of local order, and of the segregation of solute toms at extended dislocations, to the strength of close-packed solid olutions are investigated quantitatively. The two effects are roughly f the same order of magnitude, but either may predominate in a articular alloy. The theoretical predictions for the initial yield trength of silver—gold, copper—gold, and copper—zinc alloys are n good agreement with the experimental data.

539.219

592. TEMPERATURE DISTRIBUTION DURING THE MARTEN-ITE PLATE FORMATION.
Z.Nishiyama, A.Tsubaki, H.Suzuki and Y.Yamada.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1084-90 (Oct., 1958).

With the object of obtaining some basis for the thermodynamical consideration of the martensite formation, the temperature distrib-ution during the transformation was calculated using Bunshah and Mehl's data for the speed of propagation of the transformation front. From the results it is concluded that (1) the nucleation may be treated as isothermal and that (2) the growth may also be treated in the same way if the propagation of the transformation is steady, but the treatment must be nearly adiabatic if the propagation is intermit-ent and its unit is large.

539.219

11593. ON THE SUPERSTRUCTURE OF THE ORDERED ALLOY Cu_3Pd. III. HIGH TEMPERATURE ELECTRON DIFFRACTION STUDY. D.Watanabe.
J. Phys. Soc. Japan, Vol. 14, No. 4, 436-44 (April, 1959).

For previous work see Abstr. 3760 (1957). Using a high temp-erature electron diffraction camera, Cu_3Pd alloys have been invest-igated in thin oriented, evaporated films at temperatures below and above the critical point of order—disorder. The present work has elucidated that, in alloys of α''-phase, the line-up number of anti-phase domains and the degree of order inside domains decrease with increasing temperature in the range of 20-40°C below the crit-ical point, and an abrupt decrease of the line-up number of domains occurs at the critical point. In the range of 100-150°C above the critical point, short chains of one-dimensional anti-phase domains with the same period of out-of-steps as in the ordered state remain randomly in an equilibrium state. On the other hand, anti-phase domains are absent in the alloys of α'-phase below as well as above the critical point.

539.219

11594. MAGNETIC PROPERTIES AND CRYSTAL CHEMISTRY OF ILMENITE ($MeTiO_3$) AND HAEMATITE (αFe_2O_3) SYSTEM. I. CRYSTAL CHEMISTRY. Y.Ishikawa and S.Akimoto.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1110-18 (Oct., 1958).

Solid solutions of ilmenite ($MgTiO_3$, $MnTiO_3$, $FeTiO_3$, $CoTiO_3$ and $NiTiO_3$) and haematite (αFe_2O_3) were prepared and their crystal structure was investigated by X-ray analysis. It was confirmed that the solid solutions could be classified into three groups: (1) Specimens of ilmenite haematite in the solid solution with different crystal symmetries, $R\bar{3}$ and $R\bar{3}c$ respectively and with a miscibility gap between them ($MnTiO_3$, $MgTiO_3$ and $CoTiO_3$ series). (2) Ilmenite and haematite form solid solutions in the whole range of compositions and the crystal symmetry changes from $R\bar{3}$ to $R\bar{3}c$ continuously ($NiTiO_3$ series). (3) The ranges of the crystal sym-metries $R\bar{3}$ and $R\bar{3}c$ of the solid solution overlap each other and a transformation from $R\bar{3}$ to $R\bar{3}c$ is observed in one specimen of the overlapped range ($FeTiO_3$ series). Such differences among different ilmenite and haematite systems may be attributed to the following three factors; differences in ionic radii, in electronic conductivity and in stability of other two solid solution series with spinel and pseudobrookite structures which exist in a ternary system of $MeO—Fe_2O_3—TiO_2$.

539.23 : 537.533

INVESTIGATION OF THE STRUCTURE AND OF THE PROPER-TIES OF TAPERED FILMS OF Ge, Cr AND Bi IN CONNECTION WITH THEIR SECONDARY EMISSION PROPERTIES. See Abstr. 11102

539.231 : 537.311.33

11595. SURFACE PROPERTIES OF GERMANIUM.
Y.L.Sandler and M.Gazith.
J. phys. Chem., Vol. 63, No. 7, 1095-102 (July, 1959).

Some physical and chemical properties of germanium films sputtered by a discharge in an inert atmosphere have been studied. A detailed investigation of the ortho—para conversion of hydrogen catalyzed by the germanium between 77°K and room temperature reveals a twofold origin of the conversion, magnetic and chemical; the activity due to either mechanism is remarkably high. Both mech-anisms are believed to be due to a high concentration of single or weakly coupled electrons in the defect surface. The oxygen adsorp-tion on the films at 77°K was studied by measuring adsorption ios-therms and by investigating the influence of different amounts of oxygen and of adsorbed light on the activity of the films. A weakly adsorbed layer of oxygen was found at low relative pressures at 77°K. Failure of this oxygen layer to induce a magnetic conversion in hydrogen indicates that this reversible adsorption is a weak chemis-orption. It is shown to be the precursor of a stronger chemisorption at room temperature. The reversible nature of this adsorption and its interaction with unsaturated surface electrons and with the space charge layer of the germanium is discussed.

539.232 : 537.311.33

ANODIC OXIDE FORMATION ON SILICON. See Abstr. 11021

539.234

11596. ON THE CONDUCTING SKIN OF TITANIUM DIOXIDE.
S.Yamaguchi.
Nuovo Cimento, Vol. 11, No. 6, 876 (March 16, 1959). In German.

A film of titanium on glass obtained by vapour deposition in a vacuum has been oxidized with air at room temperature. The elec-tron diffraction pattern showed that the oxide film was of the rutile type. Evidence of its electrical conductivity has been observed. R.Schnurmann

539.234 : 537.311.31

11597. THE CHANGES IN LEAD LAYERS DUE TO ANNEALING.
R.Grigorovici, N.Croitoru, A.Dévényi and A.Trutia.
Z. Phys., Vol. 154, No. 2, 160-71 (1959). In German.

Heating of thin lead films evaporated on to glass or quartz, at 77°K, lowers the electrical resistance to a minimum, this corresponding to the onset of the normal metallic behaviour as the temperature rises. At higher temperatures, a hemispherical granular form occurs with an infinite resistance. It is shown that the thickness of layers above 100 A can be determined from the minimum resistance, while that of layers as thin as 12 A can be determined by measurements on the electron optical images of the granulated layer. G.F.J.Garlick

539.234 : 537.311.33

PREPARATION OF EVAPORATED LAYERS OF HgSe AND HgTe. See Abstr. 11014

539.26 : 539.319

X-RAY DETERMINATION OF RESIDUAL STRESSES. See Abstr. 10313-14

539.26 : 539.319

X-RAY STUDY OF MICROSTRESSES IN POLYCRYSTALLINE MATERIALS. See Abstr. 10315

539.27

11598. STEPPED STRUCTURE IN MOIRÉ FRINGE. H.Hashimoto.
J. Phys. Soc. Japan, Vol. 13, No. 5, 534 (May, 1958).

Discusses the interpretation of some moiré fringe patterns obtained from electron-microscope studies using superposed crystalline films of CuS and of ZnS. J.W.Leech

539.27 : 537.533

11599. EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF INELASTIC SCATTERING ON THE CONTRAST OF SUBSTANCES OF LOW ATOMIC NUMBER IN THE ELECTRON MICROSCOPE AND ON THEIR CONTRAST-THICKNESS. W.Lippert.
Z. Naturforsch., Vol. 13a, No. 12, 1089-93 (Dec., 1958). In German.

In continuance of previous work (Abstr. 7085 of 1959), the electron transmission D through thin films of formvar and of carbon have been measured in a converted electrostatic microscope fitted with a velocity filter of the Möllenstedt type. The variation of D with angular aperture of the objective was found for films of thickness varying by an order of magnitude and at 30, 40, 50 and 100 kV. The "contrast-thickness" was evaluated in function of aperture, at each voltage, for the filtered component. It is approximately half the value of the "aufhellungsdicke" defined by von Borries, which neglected inelastic scattering. The variation of contrast-thickness (which is inversely related to scattering cross-section) with aperture, at 50 kV, was compared with the theoretical treatments due to Leisegang (Abstr. 7329 of 1952) and to Lenz (Abstr. 7490 of 1954), and found to agree closer with the former. From the relative intensities of the filtered and unfiltered beams it was calculated that the ratio of inelastic to elastic cross-section for carbon is 2, at 50 kV. V.E.Cosslett

539.27 : 537.533

IMAGE CONTRAST IN ELECTRON MICROSCOPY. See Abstr. 11125

ELASTICITY . STRENGTH . RHEOLOGY

539.31

11600. THE ELASTIC PROPERTIES OF METALS AND THE RESONATING VALENCE BOND THEORY. G.Bergman.
Acta metallurgica, Vol. 6, No. 2, 110-15 (Feb., 1958).

The elastic properties of metals with cubic close-packed and hexagonal close-packed structures are derived on the basis of the resonating valence bond theory of metals developed by Pauling. It is found that reasonable agreement between calculated and observed elastic moduli cannot be obtained on the basis of the Pauling theory in its simplest form. In this form the theory requires that the lengths of the bonds formed by a given atom are in a definite relationship to each other. It is found, however, that quite good agreement can be obtained if the theory is supplemented by the reasonable assumption that the individual bonds can also undergo deformations that are not interrelated. The supplementary assumption in effect allows the strong bond–bond interactions in the Pauling theory to be weakened.

539.31

11601. ELASTIC MODULI IN MONOLAYERS. N.W.Tschoegl.
J. Colloid Sci., Vol. 13, No. 5, 500-7 (Oct., 1958).

The surface elastic moduli are the two-dimensional analogues of the elastic moduli in three dimensions. Experimental methods are reviewed briefly, and it is shown that Fourt's "elasticity index" for an oscillating vane or needle is dimensionally incorrect, whereas the formula proposed by Trapeznikov for an oscillating disk or ring is correct and can be derived exactly by regarding the film as an elastic annulus sheared in its own plane. A dimensionally correct formula is proposed for an oscillating needle as well as for an aperiodic needle type surface torsion pendulum. The relationships between the four two-dimensional elastic constants of homogeneous isotropic films are derived and are shown to be different from the three-dimensional formulae. The maximal value of the surface Poisson's ratio is 1 instead of $\frac{1}{2}$.

539.3

11602. MECHANICAL PROPERTIES OF GLASSY BORON. C.P.Talley.
J. appl. Phys., Vol. 30, No. 7, 1114-15 (July, 1959).

Boron filaments of 1.0 and 0.2 mm diam., prepared by the reduction of boron tribromide by hydrogen, were found to be very flexible both at room temperature and when incandescent. They ha a Young's modulus about twice that of steel and a tensile strength lying between 230 000 and 350 000 lb/in^2. Other mechanical properties were a hardness greater than sapphire, a low density (2.3 gm cm^{-3}), a high M.P. (about 2000° C) and a high resistance to oxidation. H.J.H.Starl

539.37 : 537.311.

THE EFFECTS OF ELASTIC STRAIN ON THE CONDUCTIVIT OF HOMOPOLAR SEMICONDUCTORS. See Abstr. 10972

539.3

11603. POLYSLIP IN POLYCRYSTALS. U.F.Kocks.
Acta metallurgica, Vol. 6, No. 2, 85-94 (Feb., 1958).

The idea that polyslip, i.e., simultaneous glide of dislocations in many slip systems of each grain, is responsible for the plastic deformation of cubic polycrystals at low enough temperatures is discussed in the light of new evidence. Taylor's formula for the calculation of the polycrystalline stress-strain curve from the she hardening curve of a free single crystal is derived in a general way, partly following Bishop and Hill, but with emphasis on the physical implications of the assumptions involved. Homogeneous deformation need not be assumed, and none of the necessary hypotheses seems physically unreasonable. A new experimental check on the Taylor formula is presented for high-purity aluminium. A proposal to compare the polycrystalline behaviour with that of symmetrically oriented single crystals which show polyslip, in particular with the ⟨111⟩ and ⟨100⟩ tensile curves, yields a good agreement between theory and experiment. The different stages o deformation of an f.c.c. single crystal, except easy-glide, can be retraced in the polycrystal, thus permitting the ideas about the mechanisms of single crystal plasticity in the various stages to be applied to the polycrystal.

539.374 : 532.

11604. THE VISCO-ELASTIC PROPERTIES OF NETWORK STRUCTURE. III. NORMAL STRESS EFFECT (WEISSENBERG EFFECT). M.Yamamoto.
J. Phys. Soc. Japan, Vol. 13, No. 10, 1200-11 (Oct., 1958).

For Pt II, see Abstr. 8488 (1958). A statistical mechanical theory of the so-called Weissenberg effect (or, normal stress effe is presented. The weakly-coupled rubber-like network model is applied to investigate the shearing and the tensile viscosity of con trated solutions of linear high-polymers. When the viscoelastic liquid is brought to stationary shearing flow, the theory shows tha additional normal tension arises in the direction of flow owing to t orientation of the network structure in addition to the usual sheari stress. Furthermore if the fluid is in a concentric circular motic with the angular velocity gradient in the radial or the axial directi each doughnut-shaped piece along a flow line behaves as a stretch rubber loop due to the additional tension. As a result, the inner b of the liquid is squeezed. The pressure increases as one approac the rotational axis. Such pressure distribution is calculated for instruments of three types, i.e., the coaxial cylinder, the parallel plate and cone, and plate instrument. The results are qualitativel in good agreement with various experimental results reported by Roberts, Philippoff, Rivlin, Kurata, Kotaka and Tamura and others

539.37

11605. SOME APPROXIMATE EQUATIONS USEFUL IN THE PHENOMENOLOGICAL TREATMENT OF LINEAR VISCOELASTI DATA. K.Ninomiya and J.D.Ferry.
J. Colloid Sci., Vol. 14, No. 1, 36-48 (Feb., 1959).

Procedures are set out for computing successive approximat to relaxation and retardation spectra from either the real or the imaginary parts of the corresponding complex rigidity and comple compliance (which are in principle measurable functions of frequency of applied oscillatory stress), without involving numerical differentiations. Corresponding relaxation moduli and creep functions can also be obtained. J.G.Oldro

539.384

606. ON THE ORIENTATION EFFECT IN THE POLYGONATION OF BENT SILICON CRYSTALS. F.L.Vogel, Jr.
ta metallurgica, Vol. 6, No. 8, 532-4 (Aug., 1958).

Experiments on the bending of silicon crystals at elevated mperature show that the ease with which polygonization occurs pends on the orientation of the bending crystal. If the crystal is ented so that only one slip system operates in a given region, an mogeneous aggregation of dislocations is produced, and these mb readily. If, however, intersecting sets of dislocations are oduced locally, the possibility of forming Lomer-Cottrell barriers present, climb is inhibited and polygonized arrays do not appear.

539.389.3

607. RELAXATION SPECTRUM OF CHAIN HIGH POLYMERIC BSTANCES. T.Onishi and M.Yamamoto.
Phys. Soc. Japan, Vol. 13, No. 12, 1439-43 (Dec., 1958).

The wedge-type relaxation spectrum of amorphous chain bstances having next-nearest neighbour interaction is derived. he interaction is taken in the form of special square-type potential gainst a distance. The potential indicates that the chain has stiffss. The equation of motion is solved by normal coordinate method r Bueche's vibrating string model. The slope of the relaxation ectrum of the author's model is steeper than that of an ideal astic chain model for which the slope of $-1/2$ in the log–log plot proved, and coincides with the experimental data.

539.434

608. HIGH TEMPERATURE CREEP AND ANELASTIC HENOMENA IN POLYCRYSTALLINE REFRACTORY OXIDES. .Chang.
Nuclear Mater., Vol. 1, No. 2, 174-81 (July, 1959).

High-temperature creep and anelastic phenomena in polyrystalline Al_2O_3 and BeO were studied. The activation energies for oth "steady-state" creep and grain boundary relaxation are approxiately 2.0×10^5 cal/mole for Al_2O_3 and 1.2×10^5 cal/mole for BeO. ddition of small amounts of Cr_2O_3 or La_2O_3 to Al_2O_3 and of MgO to eO introduces additional grain boundary relaxation peaks at lower mperatures and reduces grain boundary viscosity. The beneficial ffects of these additives in improving the high temperature ductility f refractory oxides are briefly discussed. A correlation between the experimentally observed "steady-state" creep rates and those calculated according to the Nabarro—Herring mechanism from self-diffusion data for BeO suggests that the Nabarro—Herring mechanism may predominate in the creep of polycrystalline BeO and possibly other oxides at high temperatures and low stresses. Further verification of the observation is needed.

539.53

11609. GRAIN BOUNDARY-HARDENING DUE TO PILED-UP DISLOCATIONS. J.Takamura and S.Miura.
J. Phys. Soc. Japan, Vol. 13, No. 12, 1421-3 (Dec., 1958).

The grain boundary in deformed bicrystals of α-brass has a hardening layer of 50-100 microns in thickness. Evidence for the assumption that the hardening is attributable to the dislocations piled up against the grain boundary is provided by the fact that the amount of hardening could be reduced by the application of reversed stress, and also by the analysis of the hardness distribution which showed the amount of hardening to be approximately proportional to the density of piled-up dislocations.

539.62

11610. APPARATUS FOR THE MEASUREMENT OF FRICTIONAL FORCE BETWEEN COTTON FIBRES AND A STUDY OF THE RELATIONSHIPS BETWEEN FRICTIONAL FORCE AND FIBRE PROPERTIES. C.Nanjundayya.
J. sci. industr. Res., Vol. 17A, No. 10, 412-17 (Oct., 1958).

An apparatus for the determination of the frictional force between cotton fibres in which the method of application of pressure is simple compared to other methods, has been described. A study of the relationships between the frictional force and some of the chief fibre properties has led to the following conclusions: (i) cottons having low fibre weight per unit length (f) and of high immaturity have generally low fibre friction; (ii) significant correlation exists between the frictional force and (a) $\sqrt{f}$ and (b) l/f (l, mean fibre length); (iii) long and fine cottons give lower friction values than short and coarse ones; (iv) the higher the maturity coefficient of cotton the greater is the fibre friction; and (v) only comparative values of the frictional force for different varieties can be obtained by any particular technique because of the multiplicity of the factors influencing its determination.

PHYSICAL CHEMISTRY

PHASE EQUILIBRIUM CHEMICAL REACTIONS

541.124 : 532.73

CHEMICAL REACTION IN DIFFUSING SUBSTANCE WITH YLINDRICAL FLOW. See Abstr. 10679

541.124 : 536.7

THERMODYNAMICS OF GAS REACTIONS. See Abstr. 10936

541.126

1611. DETONATION PROPAGATION IN LIQUID OZONE—XYGEN. R.O.Miller.
. phys. Chem., Vol. 63, No. 7, 1054-7 (July, 1959).

Velocities and approximate composition limits of detonation ropagation were determined for the liquid O_3—O_2 system at 177°C. Detonations in vertical tubes were photographed with a otating-mirror streak camera. Glass tubes, 5 and 8 mm i.d., and tainless steel and lead tubes, 11 mm i.d., were used. Initiation as either by direct spark or by a 100% ozone booster charge. itial pressure was either 1.5 or 21/atm and above. In general, he detonation behaviour was as follows: (a) from about 50 to 100% y weight O_3, Chapman—Jouguet-type propagation was obtained; b) from about 35 to 50% O_3, propagating reactions were inefficient, or did not occur; (c) below about 35% O_3, no propagation was obtained. The detonation velocity for 100% ozone was about 6000 m/sec. and varied as the square root of the weight fraction of ozone in the mixture. The experimental velocities were compatible with elementary solid state model theory.

PHOTOCHEMISTRY RADIATION CHEMISTRY

541.143

11612. ON THE PHOTOCHEMICAL BEHAVIOUR OF SENSITIZED SILVER HALIDES UNDER VARIED IRRADIATION AND AFTER PRE-ILLUMINATION. E.Jeltsch.
Ann. Phys. (Leipzig), Folge 7, Vol. 2, No. 3-4, 81-6 (1958).
In German.

Crystals of silver halides sensitized by Ag_2S were irradiated at low temperatures by 40-70 kV X-rays or by Hg radiation at 4047 or 4358 A. Graphs show the rate of production of the visible absorption band by successive exposures to the same or different irradiations, at different temperatures, or with intermediate bleaching by red light. The latter process renders the crystal more susceptible to darkening on further irradiation. X-rays are more effective than visible light. Suggestions are made on the mechanisms in the crystal responsible for these effects. S.T.Henderson

DISPERSIONS . COLLOIDS . ADSORPTION

541.182.3

11613. AEROSOL SIZE AND RELATIVE HUMIDITY.
C.Orr, Jr, F.K.Hurd and W.J.Corbett.
J. Colloid Sci., Vol. 13, No. 5, 472-82 (Oct., 1958).

A theoretical and experimental investigation was made of the gain and loss of water with humidity change for particles of NaCl, $(NH_4)_2SO_4$, $CaCl_2.6H_2O$, AgI, PbI_2, and KCl having radii between 0.01 and 0.1 μ. Predictions were made using a combination of adsorption theory, the Kelvin equation, Ostwald's theory and other thermodynamic considerations. Where actual data were nonexistent, empirical relations were employed to arrive at reasonable approximations. The indicated behaviour of hygroscopic particles exposed to increasing humidity is to adsorb moisture amounting to a few molecular layers at low relative humidities; to dissolve as humidity increases, becoming saturated droplets and at the same time undergoing an abrupt size increase; and thereafter, as humidity increases still further, to grow larger and more dilute. The indicated behaviour for decreasing humidity is for the droplet size to decrease as humidity decreases and, at a humidity considerably lower than that at which the particle initially dissolved, to recrystallize, undergoing an abrupt size decrease. For nonhygroscopic compounds, no abrupt solution or recrystallization irregularities are predicted. The predictions are in satisfactory agreement with experimental findings.

541.183 : 537.533

11614. ADSORPTION OF ZIRCONIUM AND BARIUM ON TUNGSTEN AND THE ELECTRON WORK FUNCTION.
V.N.Shrednik.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 22, No. 5, 594-604 (1958).
In Russian. English summary : PB 141041T-5, obtainable from Office of Technical Services, U.S. Dept. of Commerce, Washington, D.C., U.S.A.

The variation in the field emission microscope image has been followed as zirconium is adsorbed on a tungsten point. Several series of such pictures are reproduced, corresponding to different temperatures and points of different radius. Curves are given for the fall in work function of the point with time. Two alternative mechanisms are discussed for the formation of a layer with a minimum work function. Some control experiments on the adsorption of barium on tungsten were also carried out, since in this case the detailed phenomena are well-known, whereas the adsorption of zirconium has not previously been studied. V.E.Cossiett

541.183 : 537.534

ADSORPTION AND DIFFUSION OF INERT GASES ON TUNGSTEN. See Abstr. 11130

541.183 : 537.534

FIELD DESORPTION. See Abstr. 11132

541.183.26

11615. EFFECTS OF INTERPARTICLE CONDENSATION ON HEATS OF ADSORPTION AND ISOTHERMS OF POWDER SAMPLES.
C.Pierce.
J. phys. Chem., Vol. 63, No. 7, 1076-9 (July, 1959).

Additional heat of immersion measurements for graphite in benzene confirm a previous conclusion that there is extensive capillary condensation in voids between particles when powder samples adsorb vapour at high relative pressure. Heats of adsorption, computed from heats of immersion, show that beyond the first 2-3 layers practically all the net heat is due to destruction of film surface as the interparticle spaces fill. The contribution of capillary condensation to nitrogen adsorption isotherms for powders is measured by comparing isotherms with an ideal isotherm which gives that part of the adsorption due to multilayers on the free surface. The ideal isotherm follows the equation

$$(V/V_m)^{2.75} = \frac{1.30}{\log p_o/p}$$

at all relative pressures above 0.2. The ideal isotherm is applied to experimental data to (1) determine surface area independently of a BET plot; (2) evaluate the contribution of interparticle condensation to the isotherm; (3) measure the adsorption in small pores that fill at low relative pressure; and (4) explain abnormalities in isotherms of graphite samples whose surfaces are exceptionally homogeneous. Studies of many powder sample isotherms show that interparticle condensation normally occurs, to an extent determined by the size and shape of particles and their tightness of packing.

541.183.5 : 537.311.3

CHANGES OF ELECTRIC RESISTANCE OF ANNEALED NICKEL FILMS WITH ADSORPTION OF HYDROGEN. See Abstr. 10961

CHEMICAL ANALYSIS

545.8

11616. A SIMPLE METHOD OF SPECTRAL ANALYSIS OF THE PURITY OF INERT GASES. O.P.Bochkova, L.P.Razumovskaya an S.É.Frish.
Optika i Spektrosk., Vol. 5, No. 1, 93-4 (1958). In Russian. Englis summary: PB 141047T-6, obtainable from Office of Technical Servic U.S.Dept. of Commerce, Washington, D.C., U.S.A.

The percentage of N_2 in argon in the range 0.01-15% can be determined by comparing with a photomultiplier the total intensity of a discharge with that of the N_2 bands near 3600 A, isolated by means of a filter. G.F. Lothia

545.82 : 535.41

PHOTOELECTRIC RECORDING INTERFEROMETER FOR GA ANALYSIS. See Abstr. 10872

545.822 : 550.9

11617. SPECTRAL METHOD OF DETERMINING THE ISOTOPIC COMPOSITION OF LEAD. I. A.N.Zajdel, A.G.Zhiglinski and J.Čajko.
Czech. J. Phys., Vol. 8, No. 5, 530-43 (1958). In Russian.

An apparatus was developed for analysing the isotopic compos tion of lead separated from geological samples. The light source was a water-cooled or liquid-air-cooled hollow cathode discharge tube. The high-resolution apparatus was a Fabry—Perot dielectri multilayer interferometer which was located in a pressure chambe and the scanning of isotope structure of the lead line Pb I 4057.8 A was realized by varying the pressure between the interferometer plates. The hyperfine structure of the spectral line was recorded by a photomultiplier cooled by liquid air. The real resolving powe of the apparatus was around 10^6. The causes of errors in the intensities of components of hyperfine structure of the spectral line have been considered, and the following conditions derived. (1) In order to avoid deformation of the contours of the spectral line as a result of nonlinear changes in the pressure between the interferometer plates, the recording of the hyperfine structure mu be limited to the first five or six interference orders, beginning with the moment of letting air into the pressure chamber. (2) An analysis of the time changes in the brightness of the light source a its dependence on the quantity of the tested sample and background intensity showed that analysis is best carried out for samples of 2-5 mg lead iodide. Before use the sample must be annealed for 10-20 min. (3) A study of the dependence of the intensity of the spectral line on the pressure of argon in a hollow cathode discharg tube permitted the determination of the optimum pressure, which was 0.3 mm Hg. (4) By studying the self-absorption for various quantities of the tested sample as a function of the discharge curr the authors concluded that in order to eliminate self-absorption fo amounts of about 5 mg Pb I_2 it is necessary to work at discharge currents of about 100 mA in the case of a water-cooled hollow cathode discharge tube, and at the most 50 mA for a liquid-air-cooled hollow cathode discharge tube.

545.844 : 531.7

11618. A NEW DESIGN OF THE MARTIN AND JAMES GAS DENSITY METER. K.E.Murray.
Austral. J. appl. Sci., Vol. 10, No. 2, 156-68 (June, 1959).

The gas circuits, arranged symmetrically, are of stainless st tubing. The separate thermocouples of nickel—chrome and consta tan are firmly mounted and easily removable from the anemomete block. The meter is electrically heated separately from the colun to allow of its use for programmed heating. The noise level is lov (±0.1 μV) and base line stability high. The limit of detection is 0.01 μg/ml. of pentane in N_2. The meter has a wide linear range of response with change in density. The non-linear behaviour under certain extreme conditions is explained by the spilling over of gas from the working circuit into the reference circuit.

CRYSTALLOGRAPHY

548.1 : 51

619. ON AN ASYMPTOTIC EXPANSION OCCURRING IN THE VALUATION OF A LATTICE SUM. G.H.Weiss and A.A.Maradudin. nad. J. Phys., Vol. 37, No. 8, 965-6 (Aug., 1959).
See Abstr. 5240 of 1959.

548.24

1620. THE CRYSTALLOGRAPHIC ASPECT OF THE ECHANICAL TWINNING IN Ti AND α-U. H.Kiho. . Phys. Soc. Japan, Vol. 13, No. 3, 269-72 (March, 1958).
A crystallographic study on the mechanical twinning in Ti and -U is made by a method similar to that in a previous paper, llowing more kinds of atom movements, and the twin elements, K_1, η_1 and η_2, are determined. It is found that $\{11\bar{2}2\}$ and $\{11\bar{2}4\}$ vins in Ti are reciprocal to each other and that the elements of $\{1\bar{2}1\}$ twin are in agreement with Hall's result. It is also found that general result that a plane having the smallest shear is liable to vin in order nearly holds in Ti and α-U.

548.5 : 537.311.33 : 621.315.59

1621. ON THE TECHNIQUE OF GROWING SINGLE CRYSTALS)F N—P—N GERMANIUM. M.G.Petit-Le Du. emiconductors and phosphors. See Abstr. 9597. pp. 338-43. In rench.
A description of the equipment, technique and results obtained n growing n—p—n single crystals of Ge. Control factors required o obtain reproducible transistors of specified characteristics by his method are enumerated. J.B.Birks

548.5 : 537.534

1622. PSEUDOSPIRALS, IMPERFECT STRUCTURES AND RYSTAL HABIT PRODUCED BY FIELD EVAPORATION OF ETAL CRYSTALS. E.W.Müller. cta metallurgica, Vol. 6, No. 10, 620-30 (Oct., 1958).
Spiral-like structures are frequently observed when the tip of field emission microscope is subjected to field evaporation at levated temperatures. Close inspection of tips of various metals vith the field ion microscope reveals that these structures are seudospirals, appearing as a result of eccentric bunching of low omplete low index net planes, without requiring the presence of screw dislocation. The extremely large stress of the field causes arious dislocations to move towards and to pile up at the surface, here they can be seen in the ion image. A picture is given of the tomic arrangement at a low angle twin boundary in a tungsten rystal parallel to the [100] zone. Field evaporation carried out at emperatures below the range where imperfections can move to the urface may yield perfect surfaces. Their habit is characterized y a rounded-off shape, with the radius of curvature varying in the ame sense as the work function of the particular crystallographic egion. The field strength for evaporation of tungsten at practically ero temperature is measured to be 1×10^9 V/cm on the (111) lane and 8×10^8 V/cm on the (011) plane, in agreement with the heory. Crystal surfaces, as obtained by low temperature evapor- tion at slightly lower field strengths, are also shown for platinum, ridium and rhenium.

548.5

1623. THE ORIENTATION DEPENDENCE OF ETCHING FFECTS ON GERMANIUM CRYSTALS. P.J.Holmes. cta metallurgica, Vol. 7, No. 4, 283-90 (April, 1959).
There is a marked variation with crystal orientation of the many well-known etchants for germanium. For example, some etchants like CP-4) only form etch pits at dislocation sites when the surface s within a few degrees of (111) or (100). The detailed results of etching are dependent, in many cases, on the exact conditions of attack (temperature, impurity content of the semiconductor, etch composition, and illumination). A convenient way of studying these effects is by treating small polished hemispheres of single-crystal germanium, and examining the results as a function of their position on the crystal. By this means, real etch features may be distin- guished, by their recurrence in positions determined by the crystal symmetry, from artefacts, and the time and expense of preparing many accurately oriented flat surfaces are avoided. Some etchants have been shown to attack all surface orientations similarly, while others (notably the HF—H_2O_2 series of etchants) show certain effects only over angular ranges of a few degrees. There is some evidence that the variations are due not only to etch rate differences, but to changes in the actual mechanisms of etching with orientation.

548.5

11624. CATHODIC BOMBARDMENT ETCHING OF NUCLEAR MATERIALS. D.Armstrong, P.E.Madsen and E.C.Sykes. J. Nuclear Mater., Vol. 1, No. 2, 127-35 (July, 1959).
A simple apparatus is described for cathodic etching by ionic bombardment. The etching conditions for a variety of metals, alloys and ceramics, including thorium, uranium, uranium carbide and uranium dioxide, are reported.

548.5

11625. A NOTE ON THE FORMATION OF ETCH PITS ON CRYSTALS. M.Yamamoto. Sci. Rep. Res. Insts Tohoku Univ. A, Vol. 10, No. 1, 1-10 (Feb., 1958).
Etch pits originate in two ways: from microscopic pits or inclusions on the crystal surface, and from dislocations terminating on the surface. In the first type the depth of the pit is unchanged but its diameter increases, as etching proceeds (temporary etch pit); and in the second type both the depth and diameter increase with time (permanent or dislocation etch pit). Etch pits with a stepped structure are considered to be a variation of the dislocation etch pit. Photographs are given illustrating these different types of etch pits. B.T.M.Willis

X-RAY CRYSTALLOGRAPHY

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS
See also the Section entitled "STRUCTURE OF SOLIDS".

548.732

11626. ELIMINATION OF THE $\alpha_1\alpha_2$ DOUBLET IN X-RAY PATTERNS. D.T.Keating.
Rev. sci. Instrum., Vol. 30, No. 8, 725-7 (Aug., 1959).
The characteristic K-radiation employed in X-ray diffraction consists of the bichromatic wavelenths $\lambda(\alpha_1)$ and $\lambda(\alpha_2)$. In practice the observed diffraction pattern is the superposition of the patterns of the two components. In many cases it is necessary to determine the diffraction pattern for a single wavelength. An analytical method for determining such a pattern from the observed superimposed pattern has been developed. The method can be applied to eliminate the doublet from the entire pattern or any particular section. The method can be used to correct diffraction patterns used in their entirety in radial distribution analysis, and is also very useful in line profile work and lattice parameter determinations.

548.733

11627. AN X-RAY COUNTER-TUBE GONIOMETER WITH A FINE-FOCUS TUBE AS SOURCE OF RADIATION.
A.Eckardt and F.Stary.
Exper. Tech. der Phys., Vol. 6, No. 5, 193-202 (1958). In German.
Some details of construction and examples of operation are given. The focus width is 30 μ, anode current 0.8 mA, and angular velocity of counter 0.14 deg/min. A.R.Stokes

548.733

11628. AUTOMATIC SCANNING INSTRUMENT FOR X-RAY LOW-ANGLE SCATTER [MEASUREMENTS]. B.L.Beck and E.L.Gunn.
Rev. sci. Instrum., Vol. 30, No. 8, 662-4 (Aug., 1959).
The instrument has high resolution and precision, with relatively little effort in semi-routine operation. The apparatus employs Kratky optical geometry (Abstr. 7870 of 1954) and a scintillation counter detector mounted on a variable speed scanning mechanism. The intensity of scattered radiation as a function of angle is plotted on a strip-chart recorder. The method of operation and examples of instrumental performance are presented.

548.735 : 539.2

WHISKER CRYSTALS WITH STRENGTH NEAR TO THE THEORETICAL. See Abstr. 11549

548.735.2

11629. CONCERNING THE TETRAHEDRAL (T = 23) AND GYROHEDRAL (O = 432) GROUPS. N.V.Belov.
Kristallografiya, Vol. 2, No. 6, 722-4 (1957). In Russian.
English translation in: Soviet Physics—Crystallography (New York), Vol. 2, No. 6, 712-14 (Nov.-Dec., 1957).

The non-commutability of the products of the rotations in each group is established. B.T.M.Willis

548.735.2

11630. A THEOREM ON THE PRIMITIVENESS (EMPTINESS) OF THE UNIT CELL OF A CRYSTAL LATTICE. N.V.Belov.
Kristallografiya, Vol. 2, No. 6, 725-7 (1957). In Russian.
English translation in: Soviet Physics—Crystallography (New York), Vol. 2, No. 6, 715-17 (Nov.-Dec., 1957).

A proof is given of the well-known and almost obvious theorem that a unit cell, constructed from the three shortest non-coplanar translations of the lattice, is primitive. B.T.M.Willis

548.735.6

11631. REDUCING THE EFFECTS OF NONUNIFORM POLE DISTRIBUTION IN INVERSE POLE FIGURE STUDIES. P.R.Morris.
J. appl. Phys., Vol. 30, No. 4, 595-6 (April, 1959).

Describes a geometrical method for weighting the contributions of individual diffraction planes in order the better to relate an aggregate physical property (e.g. the thermal expansion) with a particular fabrication direction. J.Thewlis

548.736.1 : 537.533

11632. THE MODIFICATION CHANGES AND EXO-ELECTRON EMISSION OF CHROMIUM. O.Brümmer and G.Suwalski.
Naturwissenschaften, Vol. 46, No. 7, 223-4 (1959). In German.

Further experiments to those of Kramer [The metallic state. Göttingen, Vandenhoek and Ruprecht (1950)] on chromium show that the transition from hexagonal to cubic form at 180°C is not directly related to exo-electron emission since this shows a "glow" peak at 230°C. The peak is observed in experiments on cubic chromium and is associated with adsorbed oxygen, the activitation energy involved being ≅ 1 eV. G.F.J.Garlick

548.736.3

11633. THE ATOMIC STRUCTURE OF CERTAIN FACES OF CRYSTALS OF THE ZINC BLENDE AND WURTZITE TYPE.
P.Hartman.
Bull. Soc. Franc. Mineral. Crist., Vol. 82, No. 4-6, 158-63 (April-June, 1959). In French.

The crystals considered were diamond, ZnS in both the zinc blende and wurtzite forms, and also NaCl. The configurations of the atoms in the cleavage planes of these crystals were examined and related to the electrostatic potential at the surface. J.Thewlis

548.736.3

11634. CRYSTAL STRUCTURE OF THE COMPOUNDS $MoBe_{12}$, WBe_{12} AND $TaBe_{12}$. E.I.Gladyshevskii and P.I.Kripyakevich.
Kristallografiya, Vol. 2, No. 6, 742-5 (1957). In Russian.
English translation in: Soviet Physics—Crystallography (New York), Vol. 2, No. 6, 730-4 (Nov.-Dec., 1957).

X-ray powder analysis established that all three have the tetragonal $ThMn_{12}$ type of structure. This structure is thus characteristic of the six RBe_{12} systems with R = Mo, W, Ta, V, Nb or Cr. B.T.M.Willis

548.737

11635. X-RAY ANALYSIS OF STRUCTURE OF FROZEN TOLUENE AND ITS SOLUTION IN ALCOHOL AT −180°C.
S.G.Biswas and S.C.Sirkar.
Indian J. Phys., Vol. 31, No. 3, 141-5 (March, 1957).

By studying the Debye—Scherrer pattern and by using Lipson's method, it has been observed that the crystal belongs to the orthorhombic system. The dimensions of the unit cell are a = 7.338 A, b = 8.606 A and c = 9.20 A. The density of the crystal has been determined and found to be 1.061. The number of molecules in the unit cell is 4. The crystal probably belongs to space group C^7_{2v}. The Debye—Scherrer patterns due to frozen ethyl alcohol and frozen solutions of toluene of strength 81% and 35% in ethyl alcohol (and also of liquid toluene at −80°C) have been studied and the results indicate that both the solutions in the solid state are amorphous. In the 81% solution cybotactic groups of toluene molecules are present but their number is reduced by alcohol molecules and the latter molecules do not form groups in the frozen solution. In the 35% solution groups due to ethyl alcohol molecules are present and in this case also the number of such groups is reduced by toluene molecules. It is pointed out that these results explain the Raman spectra in the low frequency region observed by Kastha (1956).

548.73

11636. CRYSTAL STRUCTURE OF FROZEN CYCLOHEXANE AT −180°C. G.S.R.Krishna Murti.
Indian J. Phys., Vol. 32, No. 10, 460-3 (Oct., 1958).

The Debye—Scherrer patterns of frozen cyclohexane at −5°C and −180°C were photographed and analysed. At −5°C the crystal is cubic with a = 8.80 A. At −180°C the crystal is monoclinic with a = 8.82 A, b = 9.84 A, c = 15.90 A and β = 109°. The density of cyclohexane at −180°C was measured and the number of asymmetri molecules in the unit cell was found to be 8. The space group C_s^3 is assigned to the crystal.

548.73

11637. THE CRYSTAL STRUCTURE OF BENZENE AT −3°C.
E.G.Cox, D.W.J.Cruickshank and J.A.S.Smith.
Proc. Roy. Soc. A, Vol. 247, 1-21 (Sept. 9, 1958).

A new X-ray analysis has confirmed that the space group is Pbca, with four molecules per unit cell, and a = 7.460, b = 9.666 an c = 7.034 A. 284 structure factors have been measured from oscill tion photographs using CuKα radiation. The structure suggested by Cox (1932) was refined by the Fourier transform method and by two dimensional Fourier and difference syntheses. The coordinates de rived from the projections were refined by three-dimensional differential syntheses in which isotropic thermal parameters were used and termination of series errors corrected by the backshift method. After five differential cycles, electron density and difference maps calculated in the mean molecular plane revealed apprec able angular oscillations of the molecules about their senary axes. The refinement was continued by means of three-dimensional diffe tial syntheses with anisotropic thermal parameters for the carbon atoms, and difference syntheses computed in the plane of the molec and adjacent parallel planes. The criterion finally used to determi the anisotropic parameters was the equality of the observed and ca culated atomic peak curvatures, the scale factor being adjusted to give the corrected integrated number of electrons in the molecule. The r.m.s. amplitude of angular oscillation about the senary axis i approximately 7.9°. An important consequence of the molecular angular oscillation is that the mean C—C bond length is increased 0.015 A to 1.392 A, the likely limits of error being not less than 0.010 A. The result agrees satisfactorily with other determination of the C—C distance in benzene, notably Langseth and Stoicheff's value (1956) of $1.397_4 \pm 0.001$ A from the Raman spectrum of the g The carbon ring is accurately planar, individual coordinates being only 0.0013 A from the mean plane. The final value of the residua R was 9.9%. During the refinement, an attempt was made to deriv an accurate difference synthesis from which conclusions about bon ing electrons could be drawn. The experimental data did not prove sufficiently reliable, and only very tentative conclusions have been obtained. Detailed examination of the crystal structure has shown that the molecules pack together like sheets of six-toothed gear wheels. This allows an easy in-phase oscillation of the molecules about theis senary axes, and explains the large r.m.s. amplitudes observed. Occasional rotations of molecules in groups are probab responsible for the narrowing of the nuclear magnetic resonance l above 120°K.

548.7

11638. ON THE SUPERSTRUCTURE OF THE ALLOY Au_3Mn.
D.Watanabe.
J. Phys. Soc. Japan, Vol. 13, No. 5, 535 (May, 1958).

Single crystal electron diffraction photographs from very thin foils were interpreted in terms of a complex unit cell. This cell i built from simple orthohombic units of Cu_3Au type with a_1 = 4.08, a_2 = 4.05 and a_3 = 4.03A in such a manner that the adjacent simple units are out of phase with each other. J.Ad

GEOPHYSICS

550.341 : 534.647

RESPONSE CHARACTERISTICS OF ELECTROMAGNETIC SEISMOGRAPHS. See Abstr. 10724

550.38 : 523.75 : 537.591

SOLAR CONTROL OF SOME UNUSUALLY REMARKABLE GEOPHYSICAL EVENTS. See Abstr. 11171

550.384 : 538.08

MEASUREMENT OF RAPID VARIATIONS OF THE EARTH'S MAGNETIC FIELD. See Abstr. 11185

550.384.4

11639. ON THE GEOMAGNETIC S.d. FIELD. H.Maeda.
J. Geomagn. Geoelect., Vol. 10, No. 2, 66-8 (1959).

Discusses the electric field necessary to produce average "disturbed-day" daily magnetic variations, and the structure of the polarization field due to the currents induced by wind.

S.J.St-Lorant

550.385 : 523.164.32

RELATION BETWEEN SOLAR RADIO OUTBURSTS AND GEOMAGNETIC STORMS. See Abstr. 10512

550.385 : 523.164.32

CHARACTERISTICS OF SOLAR OUTBURSTS TO EXCITE GEOMAGNETIC STORMS. See Abstr. 10513

550.837.2

11640. MATHEMATICAL FORMULATION AND TYPE CURVES FOR INDUCED POLARIZATION. H.O.Seigel.
Geophysics, Vol. 24, No. 3, 547-65 (July, 1959).

A basic mathematical formulation is developed for overvoltage and other induced polarization phenomena. Starting from the fundamental representation of a volume dipolar distribution, one is led to the concept of a change in apparent conductivity due to polarization effects. The mathematical solution of induced polarization phenomena, therefore, reduces to the appropriate solution of Laplace's equation for the same geometry and conductivity distribution ignoring polarization, followed by partial differentiation of the apparent resistivity function so determined. The dielectric constants of the media are not involved in the solution. As examples of the use of the representation, the response of a polarizable sphere and of a polarizable lower layer in a typical two-layer case are presented. Actual field results are shown illustrating the use of the latter solution.

550.837.3 : 537.311

IMAGE ANALYSIS OF MULTIPLE-LAYER RESISTIVITY PROBLEMS. See Abstr. 10958

550.837.6

11641. UNIQUE DETERMINATION OF CONDUCTIVITY, SUSCEPTIBILITY, SIZE, AND DEPTH IN MULTIFREQUENCY ELECTROMAGNETIC EXPLORATION. S.H.Ward.
Geophysics, Vol. 24, No. 3, 531-46 (July, 1959).

The response of a conductive, magnetic sphere in a uniform, alternating magnetic field, is a function of the conductivity, permeability, and radius of the sphere and of the frequency of the alternations. Over one range of frequencies, eddy-current density in any given sphere and secondary magnetic fields of the sphere are relatively constant and high. Over a much lower range of frequencies eddy currents are negligible, but the secondary magnetic fields may be of large constant amplitude but of polarity reversed to that of the higher frequency range. At some intermediate frequency the secondary magnetic fields will be entirely quadrature with respect to the inducing field. Utilization of this peculiar frequency dependence and of the geometry of the secondary magnetic fields permits unique determination of the conductivity, permeability, radius and depth to the centre of a buried sphere. The procedure for obtaining these variables is described in this article. It is shown that by completing a gravity survey as well as an electromagnetic survey over a dense, magnetic, conductive spherical ore body, it is possible to determine the above variables, plus density, uniquely. Precise identification of the material of the sphere is seen as a possible result of the application of this technique.

550.93 : 535.37

GEOLOGICAL TIME MEASUREMENT FROM ORGANIC LUMINESCENCE DATA. See Abstr. 10827

550.93 : 545.822

SPECTRAL DETERMINATION OF THE ISOTOPIC COMPOSITION OF LEAD SEPARATED FROM GEOLOGICAL SAMPLES. See Abstr. 11617

ATMOSPHERE . IONOSPHERE

551.501.81

11642. RADAR ECHOES FROM ATMOSPHERIC INHOMOGENEITIES. R.F.Jones.
Quart. J. Roy. Meteorol. Soc., Vol. 84, 437-42 (Oct., 1958).

The possibility that radar echoes from atmospheric inhomogeneities are the explanation of echoes received in conditions which make it certain they are not received from precipitation elements ("angel" echoes) is examined quantitatively. It is shown that such an explanation is theoretically possible but that the required refractive index changes are large, involving changes of a few mb in vapour pressure and/or a few degrees C in temperature in a distance of about 25 cm. Reflection of the main or side-lobe energy at a limited quasi-horizontal surface is shown to give the most likely meteorological explanation, but the inability to measure changes of refractive index in the free atmosphere to the required accuracy prevents positive confirmation.

551.510.4

11643. DETERMINATION OF THE HEIGHT OF A HOMOGENEOUS ATMOSPHERE FROM PHOTOGRAPHIC OBSERVATIONS OF METEORS. L.A.Katasev.
Astron. Zh., Vol. 36, No. 2, 334-9 (1959). In Russian.

A formula is deduced for calculating the height H of a homogeneous atmosphere from photographic observations of meteors. Application of the formula to available records yielded a value H = 73-103 km. Temperatures in the 73-103 km zone, derived from the value of H, ranged from 140° to 210° K.

551.510.535

11644. STRUCTURE AND MOTION OF LARGE INHOMOGENEITIES IN THE F_2 LAYER OF THE IONOSPHERE.
V.D.Gusev, L.A.Drachev, S.F.Mirkotan, Yu.V.Berezin, M.P.Kiyanovskii, M.B.Vinogradova and T.A.Gailit.
Dokl. Akad. Nauk SSSR, Vol. 123, No. 5, 817-20 (1958). In Russian.

Results of observations during 1956-7 are given.

J.M.Hough

551.510.535

11645. ON THE INFLUENCE OF ELECTRON–ION DIFFUSION EXERTED UPON THE FORMATION OF THE F2 LAYER.
T.Yonezawa.
J. Radio Res. Lab. (Tokyo), Vol. 5, 165-87 (July, 1958).

Theoretical height distributions of electron density in steady states in the daytime have been obtained and studies have been made of the variations of the maximum electron density and the height of its level with latitude and solar zenith distance and the influence of vertical motion of electrons and ions. First of all, geomagnetic control of the F2 layer can naturally be understood on the basis of this theory. If the vertical motion of electrons and ions are neglected, the thickness of the theoretical layer is thinner than that of Chapman's distribution and the effective recombination coefficient decreases with height at lower altitudes but becomes constant at higher altitudes, the constant being larger in higher latitudes. The maximum electron density is much less dependent on the solar zenith distance than expected from Chapman's theory and the height of maximum ionization is little influenced by the altitude of the sun. It is worth noting that the maximum electron density of the F2 layer multiplied by $\cos\chi$ is a definite function of only $(\sin I)\frac{2}{3}\sec\chi$, χ being the solar zenith distance and I the magnetic dip. As regards the effect of vertical electron–ion drift on the electron density distribution, both the maximum electron density and the height of its level increase for upward drift motion and decrease for downward

one, but the lower portion of electron density distribution is not so much influenced. This effect is very pronounced in lower latitudes, but not so in middle and, in particular, in high latitudes. If an appropriate latitudinal distribution of vertical velocity of electron–ion drift is assumed, the latitudinal distribution of the maximum electron density can be well interpreted except in the immediate neighbourhood of the equator. The observed latitudinal distribution of the height of the level of maximum ionization, on the other hand, and, in particular, the absolute values of the height observed in middle latitudes, agree fairly closely with the expectations from this theory without invoking the vertical motion of electrons and ions, and consideration of its effect makes the situation no better.

551.510.535

11646. ON THE WORLD-WIDE DISTRIBUTION OF f_0F2.
H.Shibata.
J. Radio Res. Lab. (Tokyo), Vol. 5, 235-56 (July, 1958).

The world-wide distribution of f_0F2 is treated by the separation of several components. The results are as follows. (1) The values of components free from diurnal and annual variations are considered to vary with the geomagnetic latitude. This tendency is especially strong in the component independent of the sunspot number. (2) There are no significant differences between the geographical and geomagnetic tendencies of the values of components with diurnal, annual or both periodic variations. But, from the physical point of view those may as well be considered to have the geographical tendencies. (3) There is little difference among the zones.

551.510.535

11647. CHARACTERISTICS OF F2 LAYER MULTIPLE REFLECTIONS. II.
Y.Nomura, S.Katanoi, Y.Echizenya, R.Nishizaki, K.Ishizawa, T.Mori and T.Kokaku.
J. Radio Res. Lab. (Tokyo), Vol. 5, 295-302 (Oct., 1958).

The results of statistical studies of F2-layer multiple reflections on periodical observational data of Akita Radio Wave Observatory have already been reported [J. Radio Res. Lab. (Tokyo), Vol. 2, No. 8, (April, 1955)]. Some more experiments have been made to determine the causes of occurrence of the multiple reflections. It is concluded that multiple reflections result from the convergence of energy of the echo reflected from the ionosphere with curvature.

551.510.535

11648. ON THE SEMI-DIURNAL LUNAR VARIATIONS IN THE CRITICAL FREQUENCY, SEMI-THICKNESS AND HEIGHT OF MAXIMUM IONIZATION OF THE F2 LAYER IN THE DAYTIME.
T.Yonezawa and Y.Arima.
J. Radio Res. Lab. (Tokyo), Vol. 5, 303-14 (Oct., 1958).

The daytime (from 9 to 15 hr) values of f_0F2, H_pF2 (or h_mF2) and y_pF2 (or y_mF) observed for about ten years at Kakubunji and for more than five years at Slough have been subject to analysis for semi-diurnal lunar variations for the purpose of checking the authors' theory of formation of the F2-layer. Statistical errors have in some cases prevented the deduction of definite results, but the following may be tentatively concluded. (1) Roughly speaking, the semi-diurnal lunar variations in f_0F2 and the semi-thickness (or height) of the F2 layer in the daytime are respectively in phase at Kokubunji and at Slough; the former variation reaches a maximum at about 9 and 21 lunar hours and the latter at about 0 and 12 lunar hours, which seems unfavourable to the authors' theory. (2) The amplitude of the semi-diurnal lunar variation in f_0F2 is larger by a factor of about 2 at Slough than at Kokubunji. (3) In the case of f_0F2 the results conform approximately to conventional ones. (4) As regards the height of maximum ionization, these results are almost exactly out of phase as compared with conventional ones, the cause of which is at present not clear.

551.510.535

11649. A THEORETICAL CONSIDERATION OF THE ELECTRON AND ION DENSITY DISTRIBUTIONS IN THE LOWER PORTION OF THE F REGION. T.Yonezawa, H.Takahashi and Y.Arima.
J. Radio Res. Lab. (Tokyo), Vol. 6, No. 23, 21-46 (Jan., 1959).

The electron and ion density distributions in the lower portion of the F region are considered on the basis of the theory that electron–ion pairs are produced by photo-ionization of oxygen atoms while they are lost by the following processes:

$$O^+ + O_2 \rightarrow O + O_2^+, \quad O_2^+ + e \rightarrow O' + O'', \quad \text{and} \quad O^+ + N_2 \rightarrow N + NO^+, \quad NO^+ + e \rightarrow N' + O'.$$

It is found that a certain inequality must be satisfied in order that the F1 layer may appear as a distinct layer, and from this inequality it can be concluded that the F1 layer is more liable to appear for larger values of the cosine of solar zenith distance if the relative sunspot number is the same, and for larger values of the relative sunspot number if the solar zenith distance is the same. The calculated height distribution of electron density does not well agree with observational ones owing at least partly to the lack of accuracy of the latter. Abundant existence of NO^+-ions in the upper atmosphere is predicted from the theory and in fact the percentage ratios of the number densities of O^+, O_2^+ and NO^+ observed by rocket-borne instruments can be reproduced by calculation if suitable value for the reaction rates of the above-mentioned processes are adopted These values, however, are not in harmony with observed electron densities and are not necessarily coincident with the results of laboratory experiments. The effect of destruction of molecules of oxygen and nitrogen by collision with atomic ions of oxygen on their distribution in height has been considered and found to be too small to be able to alter to a considerable extent the distribution of molecules in a condition of diffusive equilibrium or complete mixing. Evidence is presented, seemingly in favour of this theory, that the observed maximum electron density of the F2 layer near noon has a tendency to vary in parallelism with the height of its level, i.e., when one is high or low, the other is also high or low respectively, if the effect of retardation is fully removed from the data by the method of calculating the true height.

551.510.535 : 523.161

11650. SPORADIC E-REGION IONIZATION, "SPREAD-F", AND THE TWINKLING OF RADIO STARS. D.F.Martyn.
Nature (London), Vol. 183, 1382-3 (May 16, 1959).

It is shown that these three phenomena could occur when the relevant ionospheric region is moving vertically upwards. At such times, small irregularities would grow large and become capable of producing strong signal scatter. H.J.A.Chivers

551.510.535 : 523.164

11651. REFRACTION OF EXTRA-TERRESTRIAL RADIO WAVES IN THE IONOSPHERE. M.M.Komesaroff and C.A.Shain.
Nature (London), Vol. 183, 1584-5 (June 6, 1959).

Longitudinal and latitudinal gradients in ionospheric electron density lead to apparent displacements in the position of a radio star in excess of those computed for a spherically symmetrical ionospheric model. Position measurements have been made at 19.7 Mc/s and the results compared with ionospheric data.
H.J.A.Chiver

551.510.53

11652. THE CONVERSION OF IONOSPHERIC VIRTUAL HEIGHT–FREQUENCY CURVES TO ELECTRON DENSITY–HEIGHT PROFILES. J.O.Thomas and M.D.Vickers.
Radio Res. Special Rep. (London), No. 28, 48 pp. (1959).

Describes an electronic digital computer programme for calculating the distribution of electron density with height from experi mental virtual height–frequency records. The method assumes tha the N(h) curve is monotonically increasing but makes no other a priori assumptions about the shape of the layer. It allows for the effect of the earth's magnetic field. The h'(f) curve forms the input data for the machine, which calculates and prints the N(h) profile in about 20 sec. The method described is a general one, but is presen ted with specific reference to the calculation designed for a Ferran Pegasus machine. Details of a simple and rapid manual method for converting h'(f) curves to N(h) profiles are also given, together wit a classified bibliography.

551.510.53

RADIO-WAVE PROPAGATION IN THE IONOSPHERE. See als the Section entitled "ELECTROMAGNETIC WAVES AND OSCILLATIONS".

551.510.535 : 523.74

SOLAR ACTIVITY CYCLE AND SPREAD F. See Abstr. 10531

551.52

11653. RADIATION, CONVECTION AND CONDUCTION COEFFICIENTS IN SOLAR COLLECTORS. H.Tabor.
Bull. Res. Coun. Israel, Vol. 6C, No. 3, 155-76 (Aug., 1958).

Heat losses from solar collectors are usually computed on the basis of figures given by Hottel and Woertz [Transaction of the American Society of Mechanical Engineers, Vol. 64, 91-104 (1942)] The present paper suggests, after a study of the literature on convection, new coefficients for convection heat transfer as well as drawing attention to the value of the total hemispherical emissivity of glass, and to the edge losses that can occur in collectors of finite size.

551.521

1654. BLACK-BALL OBSERVATIONS AND THE RADIATION HART. J.L.Gergen.
Meteorol., Vol. 15, No. 4, 350-68 (Aug., 1958).

This paper presents comparisons of experimentally determined adiation temperatures using the black ball, with such temperatures alculated using the Elsasser radiation chart. The comparisons ow that, in general, the calculated temperatures are always armer than those observed, indicating that the earth and its atmos- here radiate less energy away to space than would be calculated. he agreement between observation and calculation appears to be est in summer, when the water-vapour path length is greater at all ltitudes, and worst in winter. A description of the approximations hich enter into the calculations and a detailed investigation of the alidity of these assumptions, obtained by noting experimental esults, are also presented. The conclusions are that some of the pproximations are experimentally verified only in part and that two f them, the separation of CO_2, ozone, and water vapour radiative ffects, and the use of a pressure scaling factor on path lengths, are learly invalidated.

551.521.1 : 620.91

1655. THE RECOVERY OF SOLAR ENERGY. PHYSICAL ROBLEMS AND ECONOMIC ASPECTS.
cta electronica, Vol. 3, No. 2, 83-187 (April, 1959). In French.

Comprises five papers, one of which gives a detailed account of nergy convertors and their applications. Each paper has a short ibliography.

551.521.2

11656. THE EMISSIVITY OF THE EARTH'S SURFACE.
J.T.Houghton.
Quart. J. Roy. Meteorol. Soc., Vol. 84, 448-50 (Oct., 1958).

Some measurements from aircraft of the emissivity of the earth's surface are described. They show that for the type of surface studied, the earth's surface is radiating as a black-body at a temperature somewhere between screen air temperature and grass or sea-surface temperature.

551.524.35 : 523.78

11657. FLUCTUATIONS OF [ATMOSPHERIC] TEMPERATURE ACCOMPANYING THE SOLAR ECLIPSE.
K.Hirao, K.Akita and I.Shiro.
J. Radio Res. Lab. (Tokyo), Vol. 6, No. 23, 47-55 (Jan., 1959).

The r.m.s. value of the temperature fluctuation in the lower atmosphere was observed during the solar eclipse, on April 19, 1958. The solar eclipse was as large as 88%. The decrement of the r.m.s. value was proportional to that of the solar radiation and the time response was very rapid.

551.524.4 : 536.253

CONVECTIVE REGIME AND TEMPERATURE DISTRIBUTION ABOVE A HORIZONTAL HEATED SURFACE. See Abstr. 10907

551.573

11658. AN EXPRESSION FOR EVAPORATION. C.Z.Erzen.
Bull. Tech. Univ. Istanbul, Vol. 11, No. 1, 1-13 (1958).

A general relationship between the factors affecting evaporation is determined by means of dimensional analysis. The experimental data investigated belong to field observations where wind is always present, however small. Therefore, the expression obtained is applicable only to outdoors and not laboratory conditions. Apart from this limitation the results of the analysis are general and are valid for all altitudes where the evaluation of evaporation is desired.

551.577

11659. MICROPHYSICAL PROCESSES IN PRECIPITATION MECHANISM. K.Isono.
Japan. J. Geophys., Vol. 2, No. 2, 1-57 (Feb., 1959).

The results are presented of an examination of cloud and fog nuclei, especially of sea salt nuclei, with an electron microscope and with the aid of a microdiffraction method. The production process of sea salt nuclei is discussed. The processes of ice-crystal formation in the air are discussed. There are solid nuclei, such as AgI, whose effectiveness as ice-forming nuclei can be explained by the oriented overgrowth of ice-crystals on them, but there are many substances, such as $AgNO_3$, CdI_2, which serve as freezing nuclei and whose effectiveness cannot be explained by oriented overgrowth. The importance of surface effects in the process of freezing of micron-sized water droplets is discussed. The results of experiments on the behaviour and the growth rate of ice crystals formed in the atmosphere are presented, together with a discussion of the controlling factors of the behaviour and the growth rate.

551.594.14

11660. A NOTE ON RADIOACTIVITY OF AIRBORNE PARTICLES.
J.Bosch and G.Ulsenheimer.
Nukleonik, Vol. 1, No. 4, 157-9 (Dec., 1958). In German.

An account is given of the apparatus used and results obtained in a continuous examination of the radioactivity of airborne particles. The results suggest that in free air long-lived, highly radioactive particles appear at sporadic intervals. C.G.Morgan

551.594.5

11661. SIMULTANEOUS OCCURRENCE OF SUB-VISUAL AURORAE AND RADIO NOISE BURSTS ON 4.6 kc/s.
R.A.Duncan and G.R.Ellis.
Nature (London), Vol. 183, 1618-19 (June 6, 1959).

A 6300 A airglow scanning photometer has recorded transient increases in intensity presumably due to sub-visual aurorae. These increases are often accompanied by an increase in radio noise at 4.6 kc/s. It is suggested that both phenomena are caused by the entry into the atmosphere of proton or electron streams.
H.J.A.Chivers

BIOPHYSICS
PHYSIOLOGICAL PHYSICS

576.3

11662. FINE STRUCTURE OF CELL NUCLEUS, CHROMOSOMES, NUCLEOLI AND MEMBRANE. H.S.Bennett.
Rev. mod. Phys., Vol. 31, No. 2, 297-300 (April, 1959).

The problem of correlating the fine structure of the nucleus with its function and with the chemical and genetic evidence is still unsolved. Some of the data, on the scope and importance of this problem, which has accumulated over the past 50 years or so, is summarized and possible directions of advance are indicated.

J.Iball

576.3

11663. INTERACTION BETWEEN CELLS. P.Weiss.
Rev. mod. Phys., Vol. 31, No. 2, 449-54 (April, 1959).

A discussion of one of the two principal ways in which cells interact: the transmission of an effect from one cell to another by direct contact. Many examples are quoted which show that cell surfaces have some specific mechanism which enables like cells to "recognize" one another and to discriminate. These specific interactions are based on specific properties of the interacting cells but because there has not been enough investigation of the molecular basis of cellular specificity very little is yet known about the molecular phenomena which govern cell-to-cell relations. It appears that the same principles of specificity will apply to intercellular activity as apply to immune reactions, enzyme-substrate interactions, pairing of chromosomes, etc. J.Iball

576.4

11664. MOTILITY OF CILIA AND THE MECHANISM OF MITOSIS. S.Inoué.
Rev. mod. Phys., Vol. 31, No. 2, 402-7 (April, 1959).

The movement of cilia and chromosomes are interpreted in terms of the microscopic and sub-microscopic structures in cells. The use of time-lapse motion pictures, polarized-light microscopy and electron microscopy has revealed many of the structural patterns in cells and the mechanisms underlying cellular movements are now more clearly related to these patterns. However no unifying molecular mechanism has yet been found for cilia beat, anaphase chromosome movement and muscle contraction. Fifty-five references.

J.Iball

576.72

11665. FINE STRUCTURE OF BIOLOGICAL LAMELLAR SYSTEMS. H.Fernández-Morán.
Rev. mod. Phys., Vol. 31, No. 2, 319-30 (April, 1959).

The salient features of the fine structure of the nerve myelin sheath, photoreceptors and other lamellar systems are described and information from electron micrographs is compared with that given by X-ray diffraction. Typical photographs are reproduced. A review of the results obtained with the above two methods suggests that these systems consist of paracrystalline lipoprotein layers containing specific enzymes associated with photopigments or specialized electron-transfer systems, organized in highly-ordered patterns. The possibility of comparing this kind of biological material to semiconductors is discussed. Sixty-eight references. J.Iball

576.72

11666. FINE STRUCTURE OF LAMELLAR SYSTEMS AS ILLUSTRATED BY CHLOROPLASTS. A.J.Hodge.
Rev. mod. Phys., Vol. 31, No. 2, 331-41 (April, 1959).

An examination with the electron microscope of the structure of the photosynthetic systems in (a) one of the blue-green algae (Nostoc), (b) a green alga (Nitella) and (c) corn (Zea mays L.). The structure is considered in relation to function and in the case of (c) a great deal of detailed information is given. Reproductions of 15 electron-micrographs illustrate the high degree of order in the membranes discussed. Some of the theories of energy-transfer are considered in relation to structural models. J.Iball

576.72 : 539.19

11667. INTERACTION PROPERTIES OF ELONGATE PROTEIN MACROMOLECULES WITH PARTICULAR REFERENCE TO COLLAGEN (TROPOCOLLAGEN). F.O.Schmitt.
Rev. mod. Phys., Vol. 31, No. 2, 349-58 (April, 1959).

A detailed discussion of the work carried out within the past few years in U.S.A. on the structure of collagen. The experimental results obtained by X-ray diffraction and electron microscopy are summarized and illustrated, and the results are interpreted in relation to the function of the tissues. Both native collagen and collagen fibres obtained from solution are dealt with. A very long spacing (2600 to 3000 A) is observed by the electron microscope in certain extracts of connective tissue, and this is assumed to be the length of the native collagen macromolecule which has a three-stranded helical structure. The long thin macromolecules are termed "tropocollagen". Sonic irradiation of collagenous material has produced many interesting banded structures which are interpreted as being produced by interactions of tropocollagen macromolecules. [See Glimcher, Hodge and Schmitt, Proc. Nat. Acad. Sci. U.S.A., Vol. 43, 860 (1957)] J.Iball

576.7

11668. MOLECULAR BIOLOGY OF MINERALIZED TISSUES WITH PARTICULAR REFERENCE TO BONE. M.J.Glimcher.
Rev. mod. Phys., Vol. 31, No. 2, 359-93 (April, 1959).

A detailed and systematic review of the present state of knowledge on the structure and composition of bone and some other calcified tissues. Many new experimental facts are reported and some novel interpretations put forward. The structure of the inorganic constituents is considered and in addition the relationship of these to the organic parts. It seems clear that the inorganic crystals in bone are located within the collagen fibrils and that their orientation is determined by the orientation of the fibrils. The crystals first appear with no asymmetry and then grow within the fibrils between tightly packed oriented chains of macromolecules and they are therefore constrained to grow asymmetrically and with their long axes parallel to the fibril direction. The actual size and shape of the crystals does not appear to be determined by the fibrils of collagen since crystals formed in cartilage and under controlled conditions in vitro in the presence of collagen appear to be identical with bone crystals although not within fibrils. There are 38 illustrations, including X-ray diagrams and electron micrographs, and 99 references. J.Iball

576.7

11669. STRUCTURE OF MUSCLE CELLS. H.S.Bennett.
Rev. mod. Phys., Vol. 31, No. 2, 394-401 (April, 1959).

A discussion of the functioning of muscles in relation to their microscopic structure. Contractile tissues exist in many different forms and it is shown that many of these, though not usually called muscle, have properties of muscle and a similar structure. Two hypotheses, relating the molecular components with ultrastructural anatomy and contraction, are considered, viz. (a) contraction is considered to be the result of a change in the configuration of a single filament, (b) the unit structure consists of two parallel, overlapping and closely spaced filaments. J.Iball

577.

11670. MECHANISMS OF MUSCLE CONTRACTION. M.F.Morales.
Rev. mod. Phys., Vol. 31, No. 2, 426-32 (April, 1959).

The fundamental problem of muscular contraction is discussed i.e. the nature of the molecular transducer which converts chemical energy into mechanical work. Some of the models which have been proposed to explain the relation between shortening of a muscle and hydrolysis of ATP are examined and it is suggested that the one put forward by Podolsky [Symposium on cardiac contractility. Annals of the New York Academy of Sciences (to be published)] has some advantages, especially over models which involve coiling. The large amount of experimental work which needs to be done in this field is stressed. J.Iball

578.084 : 535.3

11671. DIFFERENTIAL MICROFLUORIMETER FOR THE LOCALIZATION OF REDUCED PYRIDINE NUCLEOTIDE IN LIVING CELLS. B.Chance and V.Legallais.
Rev. sci. Instrum., Vol. 30, No. 8, 732-5 (Aug., 1959).

Describes a differential microfluorimeter suitable for quantitative measurement and localization of the reduced pyridine nucleotide of the intact cell by means of its fluorescence emission band at 443 mμ. Applications of the method to different types of biological material are described.

578.084 : 535.34.07

RECORDING MICROSPECTROPHOTOMETER FOR BSORPTION MEASUREMENTS ON SINGLE LIVING CELLS. ee Abstr. 10771

578.087 : 535.42

1672. VOLUME AND INDEX MEASUREMENTS OF BLOOD ELLS WITH A RECORDING DIFFRACTOMETER. M.L.Polanyi. ev. sci. Instrum., Vol. 30, No. 8, 626-32 (Aug., 1959).

The measurement of the diameter and index of refraction of pheres whose diameter is larger than the wavelength of the light sed and whose index, relative to the surround, is close to unity, s described. The measurements are based on the angular position f the first dark ring and first bright ring in the Fraunhofer dif- raction pattern. The instrument is of novel design, its main dvantages being that all the light scattered under a given angle is sed in the measurement and that the peaks and valleys in the ecorded graph are very prominent and easy to locate. The resolv- ng power of the instrument is inversely proportional to the diffract- ng angle. The use of the Van de Hulst approximate diffraction heory for obtaining the diameter and the index of the diffracting pheres from the recorded diffraction pattern is described in detail. pplication to the measurement of human blood cells, the main urpose of this work, is also completely worked out and experi- ental results are given. Very good agreement between the mean ell haemoglobin as measured with the standard procedures and the ne described here has been found.

591.18

1673. MOLECULAR ORGANIZATION OF THE NERVE FIBER. F.O.Schmitt.
Rev. mod. Phys., Vol. 31, No. 2, 455-65 (April, 1959).

The basic problems of nerve fibres are described from the oint of view of an attack on them, at the molecular level, by the echniques of biophysics and biochemistry. The structure of several erve components, e.g. the myelin sheath, are dealt with in detail as hey provide great scope for the application of such techniques. The results which have been obtained so far are limited but shed ight on more general biological problems such as the nature of ell membranes. It has not yet been possible to demonstrate tructural changes in nerves on the propagation of an impulse. 59 references. J.Iball

591.18

11674. NATURE OF THE NERVE IMPULSE. B.Katz.
Rev. mod. Phys., Vol. 31, No. 2, 466-74 (April, 1959).

A summary of current ideas on the transmission of signals along nerves including a discussion of the nature of the impulse itself and the ultra-microscopic structures in the fibre which make the transmission possible. The experimental evidence for the existence of some of these structures, e.g. axon membranes, is presented. The relation between function and structure is essen- tially still unknown. J.Iball

591.181

11675. RECOVERY PROCESSES AND METABOLISM OF NERVE. C.M.Connelly.
Rev. mod. Phys., Vol. 31, No. 2, 475-84 (April, 1959).

Experiments on the excited sciatic nerve of the frog are described which relate metabolic properties to membrane potential under specified conditions. An attempt is made to correlate changes in the rate of oxidative metabolism with electrochemical manifesta- tions of ionic movement. The molecular mechanism of active ionic transport across membranes is still almost a complete mystery. J.Iball

591.185.6

11676. RECEPTOR MECHANISMS AND THE INTEGRATION OF SENSORY INFORMATION IN THE EYE. H.K.Hartline.
Rev. mod. Phys., Vol. 31, No. 2, 515-23 (April, 1959).

An analysis of the first steps of the visual process. Examination with the electron microscope is revealing some hitherto unsuspected structures in the retina and measurements of the electrical activity of single optic nerve fibres show the pattern of the impulses initiated by different stimuli. Experiments with the eye of Limulus have shown that the response of one receptor unit is inhibited by neigh- bouring receptors. The response of a set of n interacting receptor units, measured by the frequencies of their optic nerve discharges can be expressed by a set of n simultaneous equations. J.Iball

591.51 : 518.5

COMPUTER ANALOGUE OF PATTERN RECOGNITION AND TRIAL-AND-ERROR LEARNING. See Abstr. 10495

612.014.48

11677. GENERAL FEATURES OF RADIOBIOLOGICAL ACTIONS. R.E.Zirkle.
Rev. mod. Phys., Vol. 31, No. 2, 269-72 (April, 1959).

A statement of present knowledge regarding the basic principles of the interaction of high-energy radiation with biological material. The general scope of radio-biological investigations is outlined and some of the theories are discussed. J.Iball

612.014.48

11678. RADIATION INACTIVATION OF ENZYMES, NUCLEIC ACIDS AND PHAGE PARTICLES. E.Pollard.
Rev. mod. Phys., Vol. 31, No. 2, 273-81 (April, 1959).

A description of the work being done at the Yale Biophysics Department on the inactivation of biological macromolecules and on some fundamental problems of radiation damage in biology. Some general remarks on the relation of radiation dose to inactivation are followed by details of (1) quantitative measurements on proteins and nucleic acids, (2) the inactivation of viruses in relation to their structure. J.Iball

612.014.48

11679. SOME ASPECTS OF CELLULAR RADIOBIOLOGY. T.H.Wood.
Rev. mod. Phys., Vol. 31, No. 2, 282-8 (April, 1959).

Radiation damage to whole cells is studied as a complementary technique to the study of the effect of radiation on isolated cell con- stituents. A special investigation has been made of the effect of X-rays on yeast (Saccharomyces cerevisiae) using the loss of ability to form a visible colony as a criterion of damage. The effect of oxygen in modifying almost all radiobiological responses is stressed and so is the need for an understanding of the associated mechanisms. The change in radiosensitivity with changes of phase is shown to be a good method of distinguishing between direct-action and indirect- action mechanisms. J.Iball

612.014.48

11680. EFFECTS OF RADIATIONS ON POPULATIONS OF CELLS AND MULTICELLULAR ORGANISMS. C.A.Tobias.
Rev. mod. Phys., Vol. 31, No. 2, 289-96 (April, 1959).

A review of the results which have been obtained in studies of the effect of irradiation on yeast cell populations. Genetic damage of two kinds is considered: (i) dominant lethal damage, (ii) recessive lethal damage. The significance of these results to the problems of radiation effects in mammals, including man, and to the problem of carcinogenesis is discussed. Forty-three references. J.Iball

612.8 : 159.938

11681. SENSORY PERFORMANCE OF ORGANISMS. W.A.Rosenblith.
Rev. mod. Phys., Vol. 31, No. 2, 485-91 (April, 1959).

Experiments are described which were designed to discover how man detects, orders and identifies events in his environment to which his sense organs are sensitive. This kind of study (psycho- physics) tries to apply quantitative methods to sensory communica- tions. One conclusion drawn from the experiments is that the analysis of sensory information occupies considerable time in relation to the amount of information transmitted. J.Iball

612.843

11682. THE SENSE OF VISION AS A LINEAR TRANSMISSION LINE AND THE MACH BANDS. E.Menzel.
Naturwissenschaften, Vol. 46, No. 9, 316-17 (1959). In German.

The minimal visually perceptible contrast $K_S(\rho)$ of a sinusoidal distribution of intensity of spatial frequency ρ is simply related to the contrast transmission function $W(\rho)$ on the assumption that the eye is a linear channel. $K_S(\rho)$ was measured for five observers and it was found that it had a minimum of about 1% for ρ corresponding to an angular subtense of 1°. From this $W(\rho)$ and then the visual image of an edge with a finite gradient were computed. The Mach bands appeared in the computed image. W.T.Welford

612.843

11683. THE IMAGE IN THE HUMAN EYE AND KNOWN CHARACTERISTIC PROPERTIES, ON THE BASIS OF DIFFRACTION THEORY CALCULATIONS. J.Picht.
Optik, Vol. 15, No. 2-3, 83-93 (Feb.-March, 1958). In German.

The distribution of light in the image space of the human eye is calculated by diffraction theory, taking the diameter of the pupil into consideration and assuming the image to be a luminous point at infinity. Several representations of isophotes are given.

612.843

11684. MODEL INVESTIGATIONS OF THE QUANTITATIVE UNDERSTANDING OF PHYSIOLOGICAL CONTRAST ERRORS. E.Hartwig.
Optik, Vol. 15, No. 7, 414-21 (July, 1958). In German.

The intensity distribution in screen pictures of low luminosity is often incorrectly interpreted by the viewer, thereby making the pictures very difficult to understand or leading to false impressions. An attempt was made to investigate the connection between intensity distribution and incorrect interpretation. The results obtained facilitated the determination of the true contours of the image, with the aid of the false images seen by the eye in pictures of very poor definition.

612.843.31

11685. PERCEIVED COLOR AND ITS DEPENDENCE ON FOCAL, SURROUNDING, AND PRECEDING STIMULUS VARIABLES. D.Jameson and L.M.Hurvich.
J. Opt. Soc. Amer., Vol. 49, No. 9, 890-8 (Sept., 1959).

Alternative formal definitions of perceived colour are examined. Both alternative formulations treat the responses evoked by stimulation of a focal test area, but in one case the influence of surrounding stimulation on the primary test area is taken into consideration, whereas this influence is ignored in the other formulation. The consequences of these alternative formulations for predictions of equivalent stimuli and for predictions of colour appearance under different circumstances are discussed. Sensory scaling experiments are reported which yield direct quantitative estimates of the hue, saturation, and brightness attributes of perceived colour, and of the dependence of these attributes on variations in focal, surrounding, and preceding stimulation. The relation of some of these dependencies to opponent neural induction mechanisms postulated by the opponent-colours theory is discussed.

612.843.63

11686. EFFECT OF LENGTH ON THE VISIBILITY OF A FINE LINE. J.C.Ogilvie and M.M.Taylor.
J. Opt. Soc. Amer., Vol. 49, No. 9, 898-900 (Sept., 1959).

The threshold visibility of a series of test objects ranging from a fine line to a square was determined at two orientations, vertical and oblique. It was found that as the test objects became longer and narrower the area of the threshold objects increased. The limiting width for a fine line was 0.5 sec and for a square about 12 sec. These values are comparable to those previously reported.

612.846

11687. TWO-DIMENSIONAL MOTION OF THE RETINAL IMAGE DURING MONOCULAR FIXATION. J.Nachmias.
J. Opt. Soc. Amer., Vol. 49, No. 9, 901-8 (Sept., 1959).

A new modification of the contact lens technique was employed to record simultaneously vertical and horizontal components of eye movements. These were trigonometrically transformed to yield information about retinal image motion parallel to eight retinal meridia. It was found that eye movements occur predominantly in a small range of directions, which differs from subject to subject. Correlational and other statistical analyses of drift and saccadic movements led to the following conclusions about the nature of visual fixation. (1) Saccades compensate for the displacement of the retinal image away from some optical locus, but their probability of occurrence may increase with time since the last saccade, rather than with displacement; (2) The error signal to which saccades respond is probably generated 0.10 sec prior to their occurrence; (3) Parallel to those media where saccade compensation is poor, compensation by drifts becomes appreciable.

612 8

11688. "DIFFERENCE TONES": A FALSE TERM ENDLESSLY PERPETUATED. M.F.Meyer.
J. Acoust. Soc. Amer., Vol. 31, No. 7, 1030-1 (July, 1959).

A note pointing out that the term "difference tone" is a misnomer when applied to the subjective tones heard on combination of musical primaries. The error seems to arise from Helmholtz, wh incorrectly suggested that the subjective tones discovered by Tartini were identical with Young's "beat tones" heard on combina tion of high frequency primaries differing by a small interval.
G.M.Brow

612.8

11689. SUSCEPTIBILITY AND SEX.
W.D.Ward, A.Glorig and D.L.Sklar.
J. Acoust. Soc. Amer., Vol. 31, No. 8, 1138 (Aug., 1959).

Hearing surveys indicate that women have more sensitive hearing than men at high frequencies by the time they reach their 20's and that the difference increases with age. Various explanations are offered by the authors. The present experiment was designed to test the hypothesis that there is a difference between men and women in susceptibility to temporary threshold shift (T.T.S.). The authors conclude that it does not appear that there are sex-linked differences among young people in susceptibility to T.T.S. or in the rate of recovery from exposure to noise. The present results strengthen the hypothesis that differential exposure, rather than differential susceptibility, is responsible for the observed differences between men and women in auditory sensitivity.
A.B.Woo

612.8

11690. BINAURAL LISTENING AND INTERAURAL NOISE CROSS CORRELATION. I.Pollack and W.J.Trittipoe.
J. Acoust. Soc. Amer., Vol. 31, No. 9, 1250-2 (Sept., 1959).

The identification of different interaural correlations was examined over a range of reference correlations. Interaural corre lations were produced by the method of Licklider and Dzendolet [Science, Vol. 107, 121-4 (1948)] in which three independent noise sources were combined into two outputs. The change in interaural correlation (squared) required for 75% correct identification varie from about 0.4 for a reference correlation of 0.0 to about 0.04 for reference correlation of 1.0.

612.8

11691. MASKING BY TONES vs NOISE BANDS. R.H.Ehmer.
J. Acoust. Soc. Amer., Vol. 31, No. 9, 1253-6 (Sept., 1959).

It has been proposed that tonal masking arises mainly from th cochlear activity pattern of the masking tone, modified by the form ation of beats between the signal and masking tones. The present study casts further light on these proposed mechanisms by compar ing the masking effects of pure tones of 500, 1000, 2000, and 4000 c/s at 60 and 90 dB SL with $\frac{1}{3}$ octave bands of noise of equal intensities and centred at the same frequencies. The results sho that the noise bands produce about the same amount of extended masking despite the absence of any possible aural harmonic distor tion, but greater direct masking due to the elimination of beats. Furthermore, the noise-masking curves join the tone-masking curves at the second peak in the latter, providing strong additional support for the proposed mechanisms of auditory masking.

612.8

11692. MASKING PATTERNS OF TONES. R.H.Ehmer.
J. Acoust. Soc. Amer., Vol. 31, No. 8, 1115-20 (Aug., 1959).

Monaural masking patterns were obtained for pure tones spac by octaves from 250 c/s to 8000 c/s at 20-100 dB SL on three listeners in an attempt to provide extensive data assessing the relative importance of aural harmonics and cochlear spread of masking tone activity in the extension of masking to frequencies above the masking tone. The masking patterns confirm and extend the results of others, but especially indicate that second peaks do not necessarily occur at the second harmonic of the masking tone. The masking patterns are explained in terms of (1) the activity pattern of the masking tone in the cochlea, (2) beats between signa and masking tones, (3) aural harmonics, and (4) suppression of cochlear response to the signal.

612.858

693. EXPERIMENTS ON THE BONE-CONDUCTION THRESHOLD A FREE SOUND FIELD. C.W.Nixon and H.E.von Gierke.
Acoust. Soc. Amer., Vol. 31, No. 8, 1121-5 (Aug., 1959).

Earlier investigators of the free-field bone-conduction thresh- l occluded the auditory meatus with plugs and muffs and reasoned various arguments that the real-ear attenuation obtained was s than the attenuation provided for air-conducted sound. The nclusion was that the sound perceived reaches the auditory system bond conduction. The present experiments are a check on these nclusions for the frequencies from 1000 to 8000 c/s. With the ditory canal occluded by plugs and muffs the whole skull, or ctions of it, was covered with a 2 in. layer of absorbent cotton. s muffs were not covered. A higher free-field threshold with the tton indicated that without cotton the sound was reaching the ear bone. [The sound pressure level (SPL) at the surface of the uffs was not altered by the surrounding cotton.] Cotton over the tire head raised the bone-conduction threshold by 10 to 18 dB m 2000 to 8000 c/s (8 subjects). Bone-conduction thresholds termined previously were confirmed from 1000 to 8000 c/s. The nt and back of the head were approximately of equal sensitivity th respect to bone conduction. Covering only the side of the ing the sound source raised the threshold more than covering the hadow" side alone. The results suggest a possible method for proving the effectiveness of special noise-attenuating devices.

612.858

694. IDENTIFICATION OF ELEMENTARY AUDITORY SPLAYS AND THE METHOD OF RECOGNITION MEMORY.
Pollack.
Acoust. Soc. Amer., Vol. 31, No. 8, 1126-8 (Aug., 1959).

The "method of recognition memory" is considered as a proced- e which permits the examination of the identification of element- y auditory displays without requiring the assignment of arbitrary signations to the displays. The procedure is described and ustrative results are presented.

612.858

695. NEURAL FUNNELING ALONG THE SKIN AND BETWEEN HE INNER AND OUTER HAIR CELLS OF THE COCHLEA.
.von Békésy.
Acoust. Soc. Amer., Vol. 31, No. 9, 1236-49 (Sept., 1959).

An attempt has been made to show that (1) the rotating tones in aring, (2) the rotating vibrations on the skin, (3) the difference limen for the smallest perceptible distance on the skin, and (4) Mach's law of contrast are all a consequence of the same funnelling action of the nervous system. In many situations the role of the funnelling action can be better understood if a neural funnelling unit is proposed, taking into account that a local stimulus produces both an area of activity and, around it, an area of decreased sensitivity. Since the inner and outer hair cells in the cochlea show a difference in sensitivity, the funnelling action between these areas of different sensitivity has been investigated. It has been found that, between such areas, the locus of the sensation is continuously displaced as the intensity of the stimulus is increased. This suggests that along the organ of Corti there is a longitudinal displacement produced by variations in sound pressure. Thus there seems to be a pitch-loudness coordinate system in the ear. The cochlear model with nerve supply was therefore further developed into a cochlear model with more and less sensitive nerve supplies, in order to represent the outer and inner hair cells in the organ of Corti.

614.8

11696. THE EFFECTIVE HALF-LIVES OF Cs AND I IN THE BODY. K.G.McNeill and R.M.Green.
Canad. J. Phys., Vol. 37, No. 4, 528-9 (April, 1959).

The fall in the level of Cs in three humans measured with a whole-body counter on the 0.66 MeV photopeak had an average half-life of 115 days. This value is almost 7 times greater than the figure previously accepted. A similar study on three normal subjects containing I^{131} gave a biological half-life much greater than the physical half-life J.R.Mallard

614.898 : 539.17

11697. REACTOR SHIELDING ANALYSIS. C.C.Horton.
Nuclear Engng, Vol. 3, No. 33, 515-20 (Dec., 1958).

Reviews the problems presented in the design of biological shielding, the general state of shielding analysis, and the way in which which it differs from core design analysis.

616.073.75

11698. NEW WAYS OF PRODUCING VISUAL IMAGES OF RADIOACTIVE INDICATORS IN INACTIVE BASE MATERIALS.
H.J.Kirschning.
Atomkernenergie, Vol. 2, No. 7, 245-8 (July, 1957). In German.

A review of autoradiography and some other devices — beta-microscopes,etc. H.Motz

PA8

TECHNIQUE . MATERIALS

621.794

11699. THE PRETREATMENT OF GLASS SURFACES FOR THE APPLICATION OF SILICONES IN THE PREVENTION OF ELECTRICAL LEAKAGES. I. A GLASS OF HIGH ALKALI OXIDE CONTENT. J.Edge and L.F.Oldfield.
J. Soc. Glass Technol., Vol. 42, 227T-239T (Oct., 1958).

The direct application of silicone films to some glasses, particularly those of high alkali content, is not completely effective after prolonged exposure to conditions of high humidity, such as tropicalization tests. Pretreatment of the glass surface to deplete it of alkali ions, by simple washing, or more effectively by a controlled leaching, followed by baking, before siliconing, provides maximum protection against humid conditions.

621.794

11700. A NOTE ON THE APPLICATION OF GLASS COATINGS TO URANIUM. D.Hazelby and H.Rawson.
J. Soc. Glass Technol., Vol. 42, 248T-251T (Oct., 1958).

A technique is described for the application of continuous coatings of a high expansion barium phosphate glass to uranium. The coatings were fired on at a temperature of 650°C in an atmosphere of purified argon. Best results were obtained when the coating was applied electrophoretically and when metal of fine grain-size was used.

PHOTOGRAPHY

771.531

11701. EXPERIMENTAL STUDY OF R.M.S. GRANULARITY AS A FUNCTION OF SCANNING-SPOT SIZE. G.C.Higgins and K.F.Stultz.
J. Opt. Soc. Amer., Vol. 49, No. 9, 925-9 (Sept., 1959).

Experimental data on the constancy of Selwyn granularity, $S = \sigma(D) \cdot (2a)^{1/2}$, with variations on scanning-aperture diameter are presented. Selwyn granularity S is found to be essentially constant for a series of aperture diameters from 7.5 to 384 μ if the sample is clean and has no macroscopic variations in density. The effect of sample imperfections, such as density wedging, streaks, scratches, and dirt is discussed.

771.531

11702. A METHOD OF SENSITISING CURVED GLASS PLATES. J.Davis and P.Y.Millns.
Jodrell Bank Ann., Vol. 1, No. 5, 232-6 (March, 1958).

A new method of fitting a photographic material to the steeply curved focal surfaces of Meniscus Schmidt cameras is described. Spherically curved glass plates are coated with a photographic emulsion layer which is supplied in a form suitable for stripping from the normal safety base on which it is supported. No impairment of the photographic properties of the emulsion layer occurs as a result of the transfer process. The value of the method when applied to the photography of meteors and gaseous nebulae is described.

771.531 : 537.226.3

PRODUCTION OF PICTURES ON THE SURFACE OF PHOTOELECTRETS. See Abstr. 10956

771.534

11703. A COMPARISON OF THE PROPERTIES OF PHOTOGRAPHIC PLATES ASSOCIATED WITH THE PHOTOGRAPHING OF EXTENDED AND POINT OBJECTS. I.I.Breido.
Astron. Zh., Vol. 35, No. 4, 634-42 (1958). In Russian. English translation in: Soviet Astron.—AJ (New York), Vol. 2, No. 4, 589-9 (July-Aug., 1958).

By comparing the sensitometric sensitivity of different kinds of plates with the results of photographic observations made with th Slusarev mirror-lens camera at Pulkovo, it was found that the sensitometric sensitivity of plates is a satisfactory characteristic of their practical sensitivity when photographing stars. Photometry of several photographs taken on different kinds of plates showed tha the form of the astrocharacteristic curves, i.e., graphs of the depe dence of the stellar-image diameter upon the stellar magnitude, depends little on the properties of the plates (sensitivity, contrast, and resolving power) and is determined mainly by the properties of the telescope objective. The dependence of the form of the astrocharacteristic curve on the conditions of development is also small.

771.534 : 535.31

THERMO-OPTICAL ABERRATIONS IN PRECISION PHOTOGRAPHY. See Abstr. 10731

778.34 : 539.1.0

11704. PARTICLE PHOTOGRAPHY. [Premier Colloque International de Photographie Corpusculaire].
Paris: Centre National de la Recherche Scientifique (1958) 451 pp. [Colloques Internationaux du Centre National de la Recherche Scientifique No. 79]. In French.

The conference was held at Strasbourg, in July 1957. There were 9 general review papers and 38 communications, with discussions, divided into 8 sections. Abstracts of individual papers will be found under appropriate headings in this or succeeding issues of "Science Abstracts".

778.

11705. SEVERAL RESULTS OBTAINED WITH ELECTRONIC PHOTOGRAPHY BY COUNTING ELECTRON TRACKS. A.Lallemand, M.Duchesne, L.Goldzahl, J.Duflo and J.Banaigs.
C.R. Acad. Sci. (Paris), Vol. 248, No. 15, 2191-3 (April 13, 1959). In French.

Instead of determining image details from the optical density o a photographic plate in an electron image intensifier of the type us in astronomy, in which a photographic plate is placed inside the vacuum system, a count is made of the number of electron tracks per unit area. By this means an intensity gain of 1000 has been obtained over the normal method. The new method depends on the operator's ability to distinguish electron tracks caused by the imag from those occurring at random. T.Mulve

LIST OF JOURNALS

The following list supplements the List of Journals published with the index to Volume 61 (1958). Reprints of the List of Journals can obtained from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free.
The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

ull. Japan Soc. Mech. Engrs	Bulletin of the Japan Society of Mechanical Engineers. Section 561, 5th Floor, Marunouchi Building, 2, 2-chome Marunouchi, Chiyoda-ku, Tokyo.
hem. Process Engng	Chemical and Process Engineering, incorporating Atomic World. Leonard Hill Technical Group, Leonard Hill House, Eden Street, London, N.W.1.
ortschr. Mineral.	Fortschritte der Mineralogie. Schweizerbart, Stuttgart.
Res. Inst. Technol. Nihon Univ.	Journal of the Research Institute of Technology. Nihon University, Japan.
roc. Instn Rly Signal Engrs	Proceedings of the Institution of Railway Signal Engineers. Room 252, British Transport Commission, 222 Marylebone Road, N.W.1.

NOTES

tomic Wld	Atomic World. Incorporated in: Chemical and Process Engineering [Chem. Process Engng] with issue dated August, 1959.
lect. Manufng	Electrical Manufacturing. From July 1959 this journal is published by C-M Technical Publications Corporation, 205 East 42nd Street, New York 17, N.Y. Editorial and Business address: 1250 Sixth Avenue, New York 20, N.Y.

CHANGE OF TITLE

ulletin of the British Scientific nstrument Research Association	Title changed to: Instrument Abstracts (with the issue dated May, 1959, not June).

ERRATA

Abstr. 571 (1951) line 1 : for "Pa^{223}" read "Pa^{233}".
Abstr. 1093 (1951) line 4 : for "Abstr. 6531" read "Abstr. 6531 (1950)".
Abstr. 6183 (1959) line 4 : for "(1959)" read "(1958)".
Abstr. 10629 (1959) line 2 : for "Kriachnan" read "Kraichnan".

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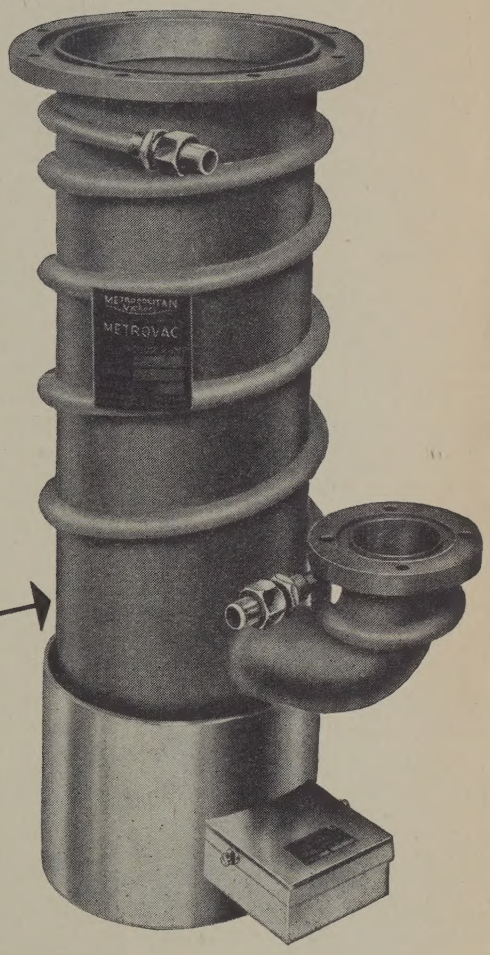

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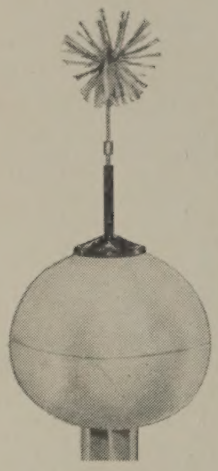

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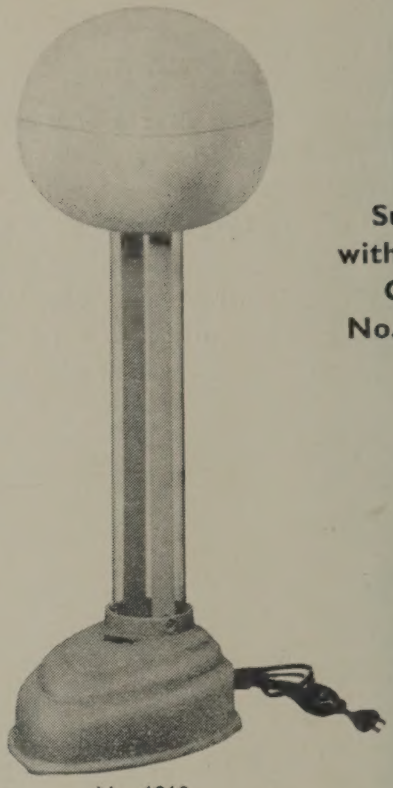

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